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by T. A. E. Lake

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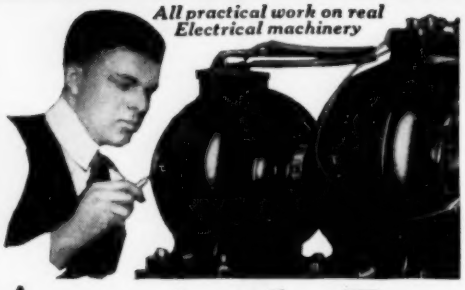

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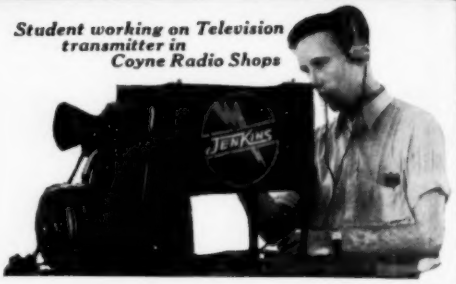

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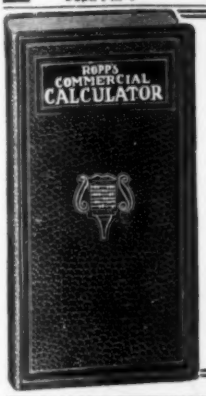

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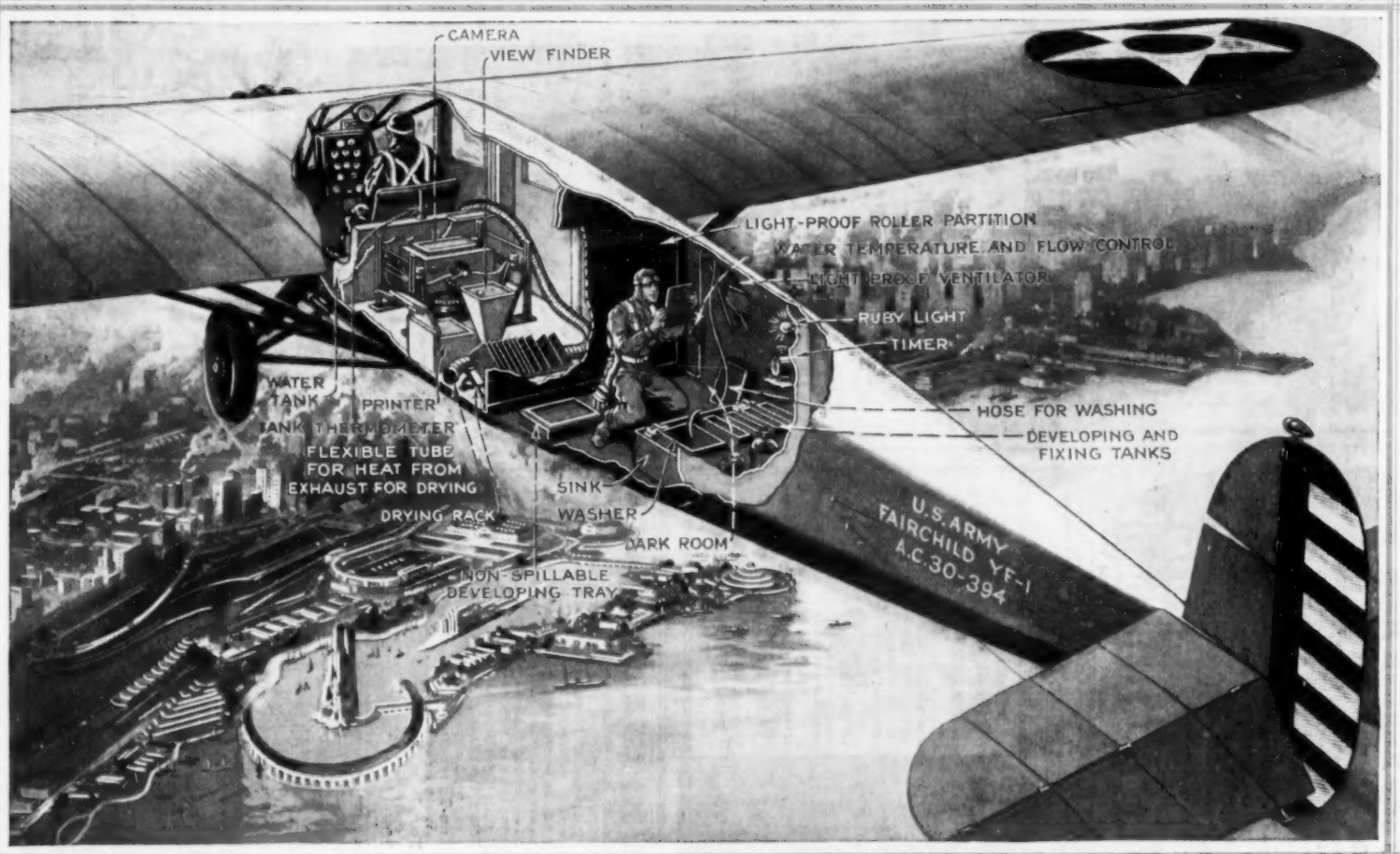

The "Flying Darkroom," a Plane Equipped to Take, Develop and Print Photographs While in Flight; in This Ship, Lieut. G. W. Goddard, Army Flyer, and an Assistant Recently Made a Mosaic Map of Chicago's Lake Front in About an Hour, Landing with the Pictures Completed

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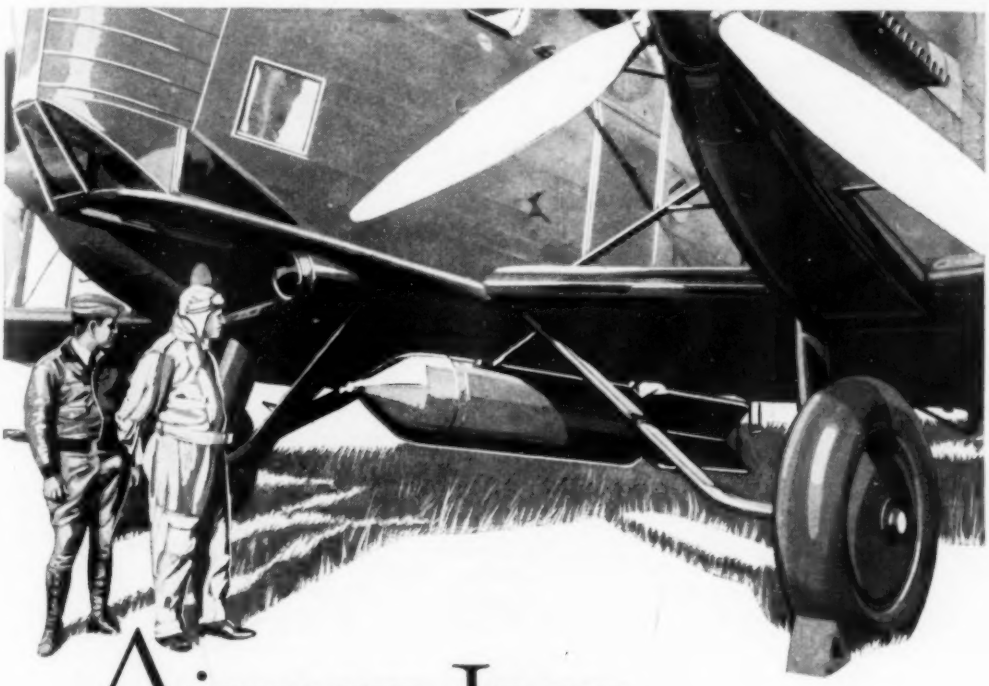

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Airmen Leap As Bombs Burst

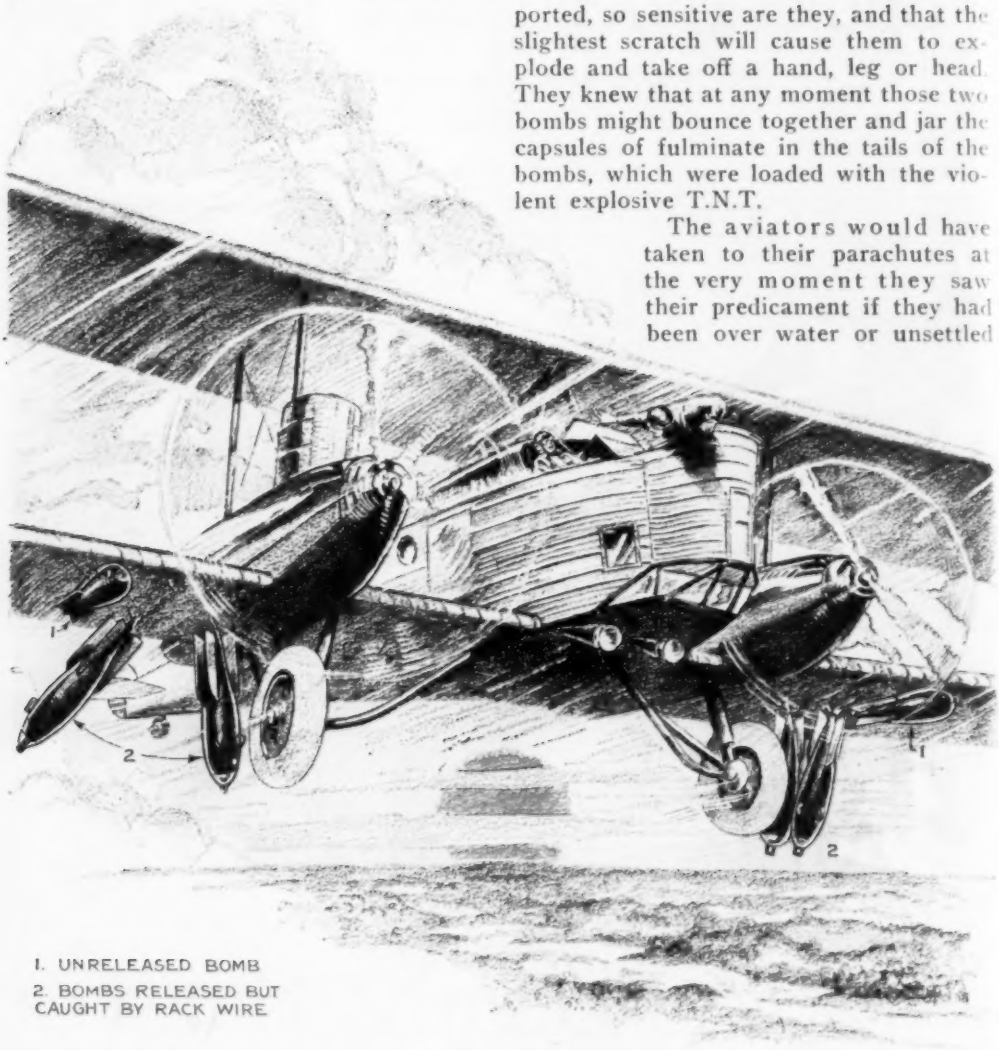
TWO aviators about a mile high. Beneath the wings of their light bombing plane dangled two live bombs, the exploding keys already pulled, but the bombs fouled on the release mechanism waiting for a little jostle or jar to rend the sky with a terrific explosion. This was the situation that confronted two army aviators near Langley field, Va., this spring.

The two aviators were engaged in practice with live bombs. They were a part of a formation which was dropping patterns of bombs upon a ground target. Eight twenty-five-pound bombs were carried beneath the wings of the fast light bombing planes. The bombs were being dropped one at a time. On the fourth trip over the target, the bomber in the back seat, who was a major of coast artillery taking a course in aerial tactics, noticed that no bomb fell after the releasing handle was pulled.

This was no cause for alarm because often bombers fail to give the release handle the right kind of a jerk and the remedy is to fly over the target again and pull the handle. Also in order to catch up with the number of bombs per trip, two yanks are usually given on the bomb handle for the release of two bombs. This is what the major had done.

ported, so sensitive are they, and that the slightest scratch will cause them to explode and take off a hand, leg or head. They knew that at any moment those two bombs might bounce together and jar the capsules of fulminate in the tails of the bombs, which were loaded with the violent explosive T.N.T.

The aviators would have taken to their parachutes at the very moment they saw their predicament if they had been over water or unsettled



1. UNRELEASED BOMB
2. BOMBS RELEASED BUT CAUGHT BY RACK WIRE

Again no bombs dropped and the pilot, an army captain, became concerned. The observer and pilot began to investigate. By looking under the edge of the lower left wing they saw a sight which made them turn pale. There were the two bombs with their safety wires pulled out, fouled on the release mechanism. They were dangling and jostling against each other playfully with each rocking movement of the plane.

Both of these officers knew all about the "insides" of the bombs. They knew that the little caps of mercury fulminate had to be carried wrapped in heavy but soft cotton bundles when they were transcountry. But they were over thickly settled territory, and the bombs might have wiped out a small village when the plane fell. The pilot decided he had to get the plane over water or a place where nobody lived before turning it loose. He motioned for the passenger, the major of artillery, to "bail out." The major climbed unsteadily to the edge of the rear cockpit and after a glance at the swinging bombs, dived into mid-air.

Then the pilot gently turned the nose of the "death plane" toward the James river. Here was a broad expanse of water fairly free of shipping and this would be the best place to unload the plane and

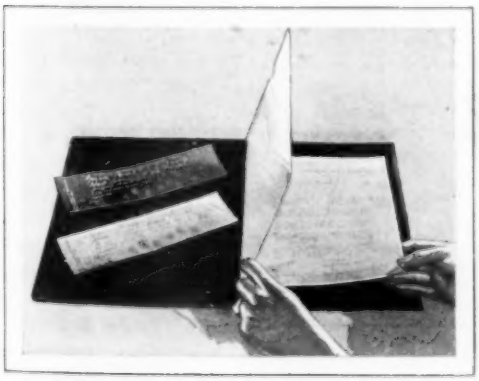
bombs. With the nose of the plane pointed to a wide empty space in the river, he "cut the gun" and climbed gingerly to the wing of the machine. He jumped and gave himself a "long count" before pulling the parachute rip cord.

But no sooner had the captain pulled his rip cord and started his slow descent than the sky was rent with a terrible explosion. The pilot was rocked by the heavy atmospheric waves, but landed safely in a plowed field.

This is the first case in aviation so far as available records show, in which an accident of exactly this sort has occurred. Planes have been reported blowing up in mid-air from their load of bombs and planes have been destroyed after landing with bombs. But bombs bursting after the passengers left the plane in mid-air is something new in military aviation.

PHOTOSTAT CAMERA IN FOLDER MAKES COPIES OF RECORDS

Doing the work of an expensive photostat camera, a light-sensitive plate contained in a small folder produces a photographic copy of any record or document simply by exposure to light for a few seconds. This substitute for the costly photostat outfit may be obtained in the folder, in which form it is convenient for carrying, or in a rigid frame. In making a picture, it is only necessary to place a film for the exposure beneath the paper to be copied, press the light-sensitive plate on the two sheets and expose to any light source. The finishing is done in the usual manner.



Light-Sensitive Plate in Folder Which Makes Photostatic Copy of Written or Printed Record

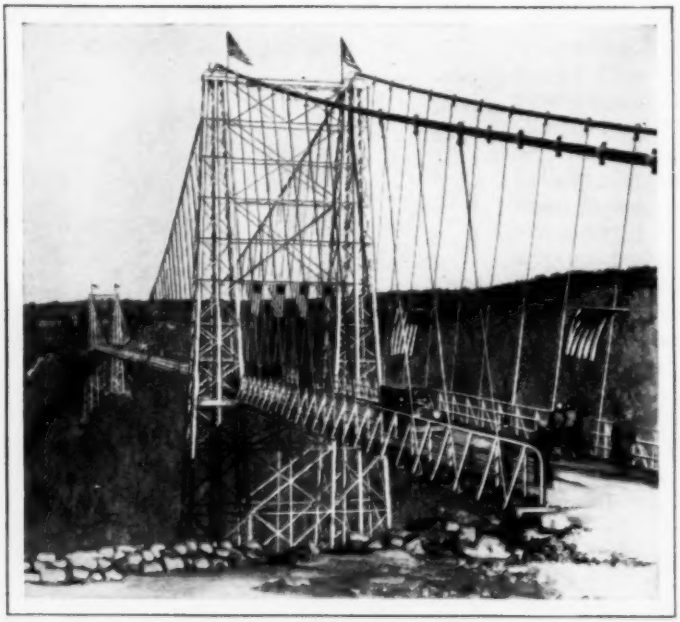
STONE LETTER SIX THOUSAND YEARS OLD IS FOUND

Document Written in Stone Some 6,000 Years Ago; It Is One of the Oldest Records in Existence

Some 6,000 years ago King Entemena of Lagash took his chisel in hand and wrote a letter on stone telling a hitherto unknown story of a David and Jonathan friendship which existed between two of the world's oldest kings. This stone letter was brought to this country and now is in the hands of a Chicago collector. It resembles a big spike and the figures are in Sumerian, an ancient Babylonian language.

LAST OF CHEMICAL ELEMENTS FOUND BY ANALYSIS

By a method of chemical analysis so delicate that it can recognize one part in 100,000,000,000 of water, scientists of Alabama Polytechnic Institute believe they have detected the one remaining unknown chemical element, number eighty-five. Ninety-two elements now form the completed list, and the new element, the eighty-fifth when they are arranged in the order of weights of their atoms, is a family relative of iodine and has been found in seawater, potassium bromide and in a number of well-known minerals. It has not yet been separated but the discoverers are attempting to make a purer concentration of the element from monazite sand and thus isolate it.



Bridge over Royal Gorge of Arkansas River; It Is the Highest Suspension Bridge, Towering 1,053 Feet above the Chasm Floor

WORLD'S HIGHEST BRIDGE OPEN TO TRAFFIC IN WEST

Spanning the Royal Gorge of the Arkansas river, the world's highest suspension bridge recently was completed and opened to traffic. It is 1,053 feet above the floor of the chasm and serves as an approach to several recent additions of the new national park of Colorado.

NO PIANIST KEEPS EXACT TIME CAMERA STUDY SHOWS

Although he may be a skilled musician, no pianist plays in strict time, even when he tries to do so. This is one of the facts disclosed by a piano camera which gives a record of the exact time at which each note is struck, the time it is released, its intensity, and also the movements of the damper pedal. It was found that each skilled pianist tested by the instrument gave a characteristic interpretation of any particular composition, and that, when repeated, the second rendition was always strikingly like the first. The variations in time were shown when the artists tried to play in time with a metronome's even beats. The deviations from time were smaller than in the artistic rendition but were in the same direction. It was also found the pianist does not strike all the notes of a chord at the same instant, the interval ranging up to about one-third of a second between the striking of the first and last note.

ANOTHER DROUTH THIS YEAR?

Will there be another drouth this year? This question has been raised by a study of weather sequences in Baltimore during the past 113 years by John R. Weeks, meteorologist. As a general rule, he found that a summer with rainfall of less than seven inches in Baltimore, compared with the average of about 12.77 inches, is followed the next summer with rainfall less than normal ten times out of eleven. Three times out of four the rainfall the next year is three inches or more below the summer normal, and six times out of eleven, it is five inches or more below normal. The driest summer on record, which occurred in 1869, was followed by a very hot summer with rainfall less than half the normal.

OIL PAD ON BATTERY TERMINAL ELIMINATES CORROSION

To avoid corrosion of automobile-battery terminals, felt pads impregnated with oil are now provided for the connections. The pads are attached by brass snaps and oil is added every three months, light motor oil being used in cold weather and heavy oil in the summer. The oil-soaked pads keep the terminals clean as the oil prevents the corrosive action.

BUSHMEN KEEP WATER IN OSTRICH EGGS FOR DRY SEASON

Bushmen who live in the dry country of South Africa obtain their water supply in the dry season from ostrich eggs buried deep in the sand. The eggs are gathered and the inside of each carefully removed through a hole without breaking the shells. These hollow shells are filled with water during the rainy season, the eggs are sealed with a chunk of clay and then are buried. When the dry season arrives, the natives simply dig up the eggs and break them open.

ALUMINUM KITE WILL STAND HARD KNOCKS

Withstanding many more hard knocks than the ordinary paper kite, one that is made of aluminum almost as light in weight and as thin as paper is now being offered. It can land in a tree with little injury since a dent or two can be straightened out quickly. The aluminum kite requires but a fair breeze and only a trifle more velocity to put it up than the ordinary paper variety.

Kite Made of Thin Aluminum Sheets Which Can Stand More Knocks Than Ordinary Paper Kind

Portable Detectors Developed for Japanese Army; They Warn of the Approach of Enemy Planes

JAPAN PREPARES TO REPEL ATTACKS FROM AIR

Japan is engaged in modernizing its army and among the latest military equipment provided are portable airplane detectors mounted on light trucks. These detectors, capable of locating enemy aircraft, and warning of their approach, are in the form of huge horns that taper to a point at one end, and look like the loud speakers employed for outdoor gatherings in this country.

AIR AND PAPER INSULATION SUGGESTED FOR ICE BOXES

Sheets of paper with a one-tenth-inch air space between them may make a more satisfactory insulation for the walls of ice boxes than solid boards. This is indicated in a report to the American society of refrigerating engineers. The ideal insulating material would be nothing but air if it transmitted heat by conduction alone, but radiation and convection enter into the problem, and the net insulating effect is poor. It has been found that paper reduces convection and radiation without increasing conduction very much.

Irish Wolfhound That Rears Itself to a Height of Over Seven Feet and Weighs 175 Pounds

HOUND OVER SEVEN FEET TALL IS PLAYMATE OF MAN

One California man has as a playmate a dog that stands seven feet nine inches tall when reared on his hind legs. He is "Beau Wolf," an Irish wolfhound weighing 175 pounds, and his master's young daughter rides him bareback like a pony.

INDIAN PLANTS POINT THE WAY TO NEW FOOD SOURCES

Experiments are being conducted by the department of agriculture with roots, herbs and bulbs which the Indians once used for food, but which have never been cultivated by the white man. The tests are in line with a plan to investigate the latent resources of uncultivated plants indigenous to the United States, and scientists are already convinced that many of these Indian plants contain valuable constituents which have been overlooked by the present-day civilization. Among the interesting plants which have been studied and bear possibilities for future cultivation are the prairie potato, which has a thick skin and is less susceptible to insect injury than the common variety; wild licorice, which contains the active principle of licorice used in candies, and camas, used by the Indians for making a sweet sirup.

AERIAL LIFEBOAT TO ANSWER SOS BY LAND OR SEA

To speed aid to aircraft and ships in distress at sea, or to locate troubled vessels, the Santa Monica, Calif., coast guard has added a 600-horsepower amphibian plane to its equipment. The big craft has demonstrated its ability to take off from and land in rough water. Coupled with its speed of 140 miles an hour, its seaworthiness is expected to make it a valuable addition.

MUFFLERS FOR PLANE ENGINES TO REDUCE NOISE

Experiments are being made by government engineers that may effect a considerable reduction in the noise made by airplane engines through the use of special mufflers, somewhat like those with which automobiles are equipped. A 180-horsepower V-type eight-cylinder engine has been installed on a test stand and various types of mufflers are being tried with it. Precision instruments record both the intensity of noise and the loss of power, if any, with each kind of muffler tested. It is hoped that a muffler may be found which will eliminate much of the engine noise without greatly diminishing power output.

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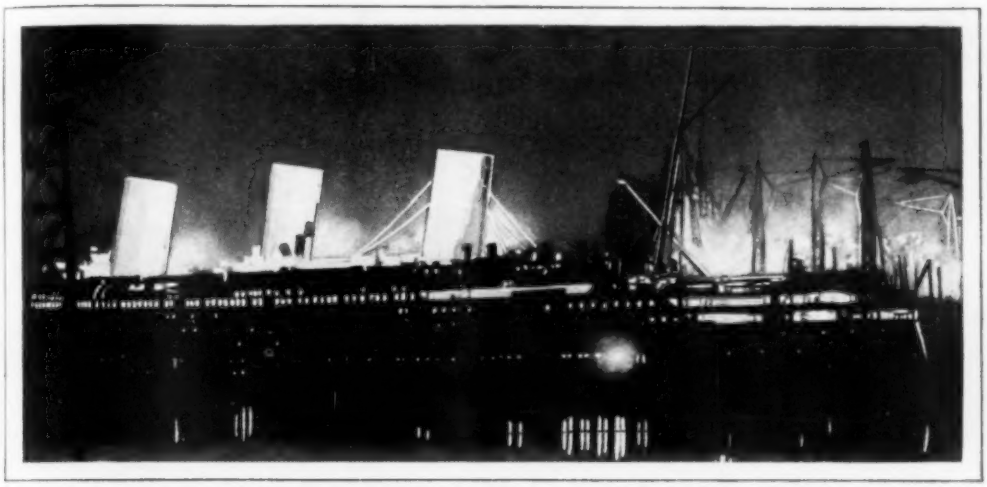
Trying Out a Muffler on Airplane Engine in Effort to Reduce Noise without Decreasing Power



Floodlighted Funnels of the "Empress of Britain" Which Serve as Mobile Beacons for Airplanes and Ships; They Are Visible to Ships for Thirty Miles and to Planes Fifty Miles

FUNNELS OF SHIP ILLUMINATED AS BEACON FOR PLANES

Towering funnels of ocean liners now are being floodlighted at night to serve as beacons for seagoing aircraft and also for other ships. The stacks of the "Empress of Britain" have been illuminated, and these mobile beacons can be seen for thirty miles, being visible more than an hour before the vessel itself comes into view. The reflection against a low ceiling at night can be seen even farther, and flyers 1,000 feet up can use the funnels as a guide fifty miles away.

BIRDS EXCEL MAN'S AIRPLANES AS EFFICIENT FLYERS

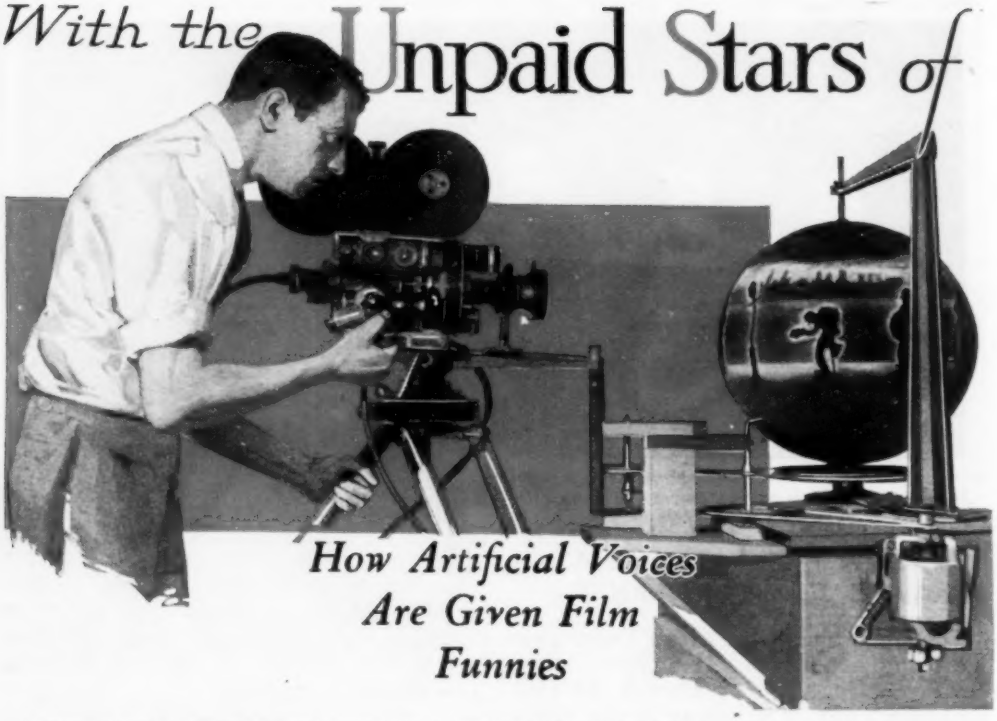
Birds are still more efficient flyers than any airplane designed by man. They have better streamlining and get more mileage out of a unit of energy than any airplane now in existence or likely to be built. Birds have so reduced the weight of other body parts that they can devote from one-sixth to one-half their total weight to the flying muscles. In the pigeon, these muscles weigh as much as all other parts of the bird combined. The streamlining of the body smooths out hollows and irregularities with almost weightless feathers. Many flying birds tuck up their feet like planes with retractable landing gear, and those too long-legged to do so, trail these members to decrease wind resistance. Birds assimilate more of what they eat than mammals, their blood carries a higher number of red corpuscles, and their breathing apparatus operates as the wings are moved, so they are far less likely to tire than any mammal.

HESITATING HAND GOLF PLAYED WITH LOADED BALLS

Hesitating hand golf, a variation of golf and marbles that is winning favor, seems a contradiction to the adage that he who hesitates is lost. Hesitating is part of the sport, and the balls that are used are loaded with shot to make them pause. The game itself is simple. All that is necessary is a hollow rubber ball loaded with shot, and nine approaches made of cardboard with a receptacle for the ball near the top. The object is to roll the loaded ball into the bull's-eye, but the feat is made difficult by the inclined plane up which the ball must be propelled.

Hand Golf Played with Balls Loaded with Shot

With the Unpaid Stars *of*



How Artificial Voices Are Given Film Funnies

Photographing a Panoramic Background for a Talking Cartoon; the Globe with Its Painted Figures Is Rotating While the Camera Takes Pictures of the Movement

AN ARMY of unpaid actors dance, sing and cavort in theaters throughout the civilized world every night, performing superhuman feats that bring forth tears and laughter.

Their seven-minute performance costs about $20,000 and weeks of labor on the part of 100 people.

These robot actors have given birth to an industry capitalized at $4,000,000, and they boast 100,000,000 followers all over the globe. They are fleshless actors but nobody denies them life. In a breath-taking shift of scenes, the hero swings a lariat and lassos a running locomotive; in an auto race he makes Colonel Campbell's roaring "Bluebird" look like a snail; sailing an airship through the sky, he wipes his brow with the Moon as a handkerchief, and commandeers Mars to protect him from the sun's rays; with one stroke, he slays the great dragon, and in the next stroke conquers the vicious octopus.

Animated cartooning is a hand-made industry; every detail of the action must be drawn out laboriously by artists. From sixteen to twenty-four drawings are necessary to complete one action such as the winking of an eye or the throwing of a rope, and from 8,000 to 10,000 drawings are necessary for a seven-minute reel.

But invention has recently come to the aid of art and will soon make the animated-cartoon movies more wonderful to behold, more breath-taking and more awe-inspiring. A long painstaking search to find a method of creating synthetic sounds on film has recently been rewarded by a patent to the Fleischer studios, which supplies Paramount with one "talkartoon" each week.

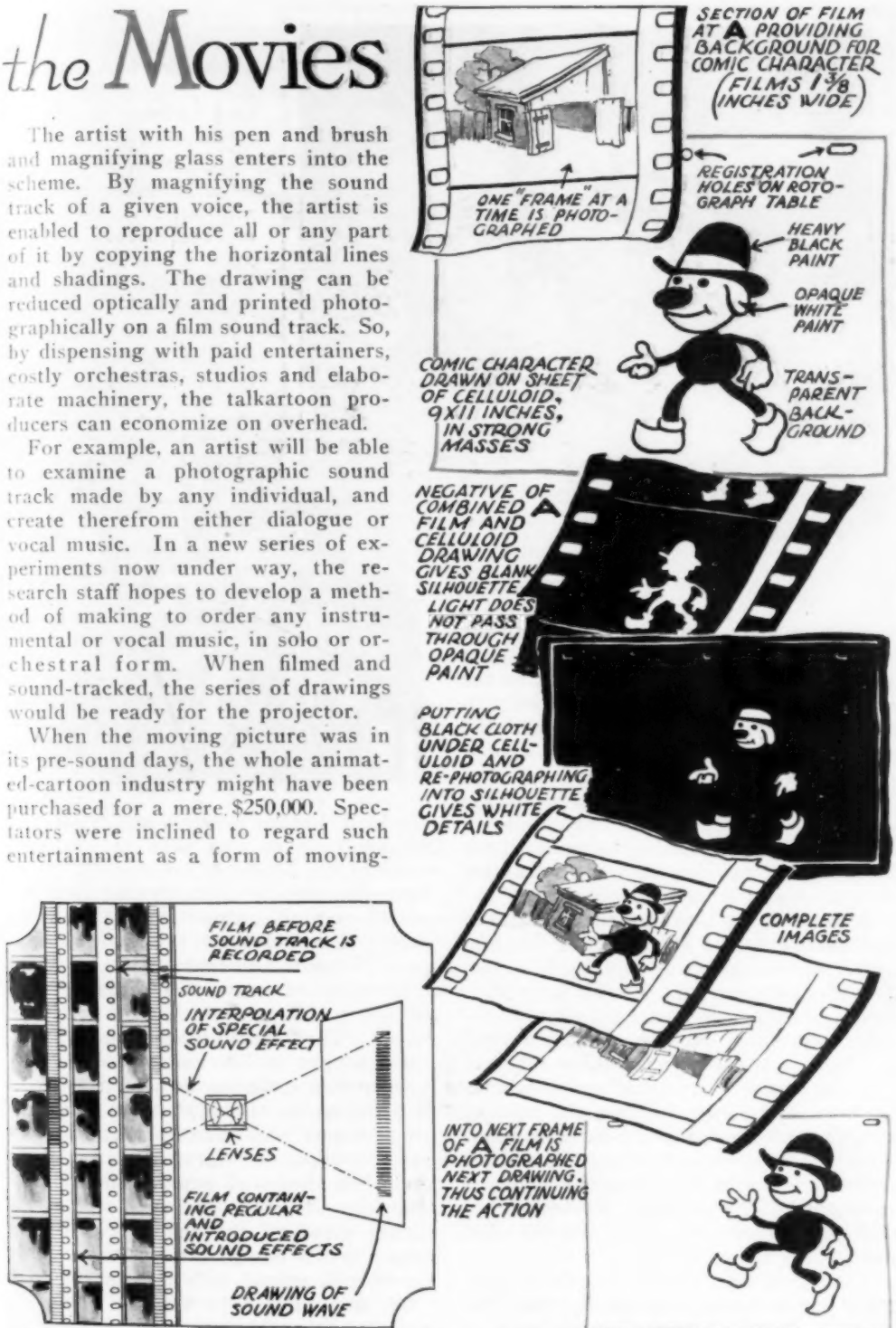
The method is really a system of "fingerprinting" sounds, whether they be made by voice or by mechanical device. By first making sound tracks of all the letters in the alphabet, then combining these sounds into words, it has been possible to create characteristic patterns for letters, words, musical notes, and other specialized sounds. Synthetic dialogue and synthetic music can now be inserted at precise places in a film, so as to carry out the story.

the Movies

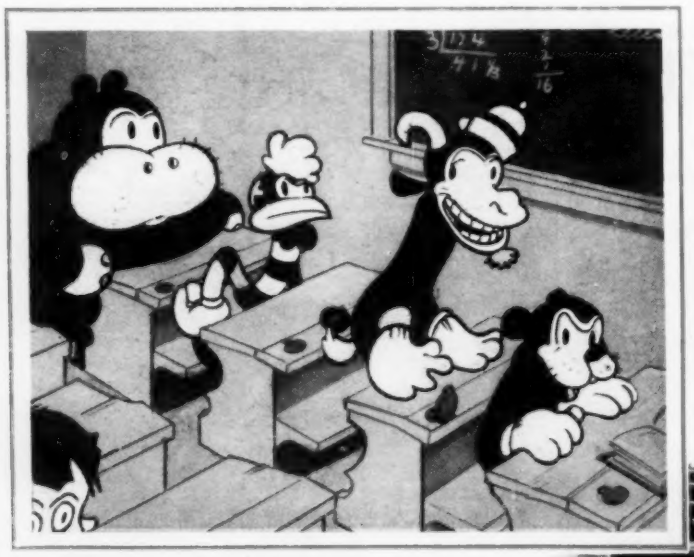
The artist with his pen and brush and magnifying glass enters into the scheme. By magnifying the sound track of a given voice, the artist is enabled to reproduce all or any part of it by copying the horizontal lines and shadings. The drawing can be reduced optically and printed photographically on a film sound track. So, by dispensing with paid entertainers, costly orchestras, studios and elaborate machinery, the talkartoon producers can economize on overhead.

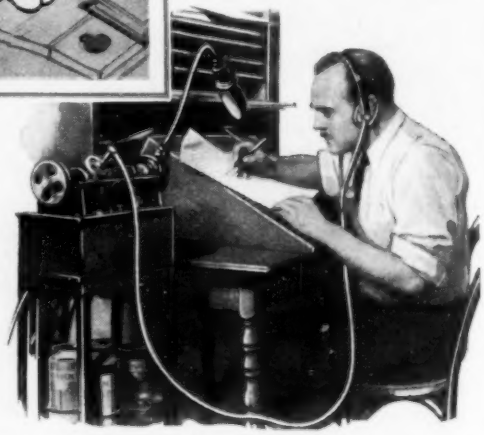
For example, an artist will be able to examine a photographic sound track made by any individual, and create therefrom either dialogue or vocal music. In a new series of experiments now under way, the research staff hopes to develop a method of making to order any instrumental or vocal music, in solo or orchestral form. When filmed and sound-tracked, the series of drawings would be ready for the projector.

When the moving picture was in its pre-sound days, the whole animated-cartoon industry might have been purchased for a mere $250,000. Spectators were inclined to regard such entertainment as a form of moving-


SECTION OF FILM AT A PROVIDING BACKGROUND FOR COMIC CHARACTER (FILMS 1 3/8 INCHES WIDE)
REGISTRATION HOLES ON ROTO-GRAPH TABLE
ONE "FRAME" AT A TIME IS PHOTO-GRAPHED
HEAVY BLACK PAINT
OPAQUE WHITE PAINT
TRANS-PARENT BACK-GROUND
COMIC CHARACTER DRAWN ON SHEET OF CELLULOID, 9X11 INCHES, IN STRONG MASSES
NEGATIVE OF COMBINED A FILM AND CELLULOID DRAWING GIVES BLANK SILHOUETTE
LIGHT DOES NOT PASS THROUGH OPAQUE PAINT
PUTTING BLACK CLOTH UNDER CELL-ULOID AND RE-PHOTOGRAPHING INTO SILHOUETTE GIVES WHITE DETAILS
COMPLETE IMAGES
INTO NEXT FRAME OF A FILM IS PHOTOGRAPHED NEXT DRAWING, THUS CONTINUING THE ACTION
FILM BEFORE SOUND TRACK IS RECORDED
SOUND TRACK
INTERPOLATION OF SPECIAL SOUND EFFECT
LENSES
FILM CONTAIN-ING REGULAR AND INTRODUCED SOUND EFFECTS
DRAWING OF SOUND WAVE

The Various Operations Necessary to Produce One Single View in a Talking Cartoon and the Sound Effects; on the Screen the Picture Is Viewed But an Instant





Above, Typical Talking-Cartoon Scene; Right, an Animator Timing the Action to the Music

picture trickery. But with the aid of sound, the hand-made movies achieved a huge popularity. They appeal alike to the Chinese coolie and Alaskan Indian. But sound multiplied production costs to the extent where producers were driven to beg aid from inventors. To make the sound record on a film in the usual way involves great labor, time and expense. The orchestra must rehearse painstakingly; special sound experts are employed. Besides, sound records frequently have flaws, and sometimes a voice or dialogue may accidentally be omitted.

Another invention designed to make animated cartoons more natural is a machine which combines two kinds of action on a single print. Thus it is possible to film a background of a busy street, using the ordinary camera. If it is desired to show a robot actor making his way through traffic, the machine combines the two films, one showing the moving vehicles and the other the cartoon actor. The end product is a single film which portrays a mythical character crossing a real street. The separate actions are so well controlled and co-ordinated that movie fans are mystified.

This invention opens a whole new realm for animated moving pictures. The artist is saved all the labor incident to drawing in a moving background, and the producing cost is reduced proportionately. Hence we find film funnies progressing swiftly and offering manifold opportunities for man's imagination. The ordinary photographic camera can reveal only the external activities of man. The animated movies attempt to film what goes on inside the brain. In the short career and in the success of this new industry, its backers have suddenly discovered what passionate interest men take in picturizations of the brain. What thought do we have on entering a graveyard? An animated cartoonist thinks that a dance of skeletons would depict the scene in some people's heads, and that is what he draws.

Earthbound men have often thought of flying through the air on feathered wings. The animated cartoonist brings this thought to life and actually shows how a man imagines he would fly if he had the wings of a bird. The troupe of robot actors leap out of a magic lantern after millions of scratches have been made on sheets of paper. The original drawings are made in pencil. Then the actors move to the inking department where artists design their clothes; every drawing is traced with ink on celluloid. They are colored in various shades of gray, white and black.

In their costumes the actors march to

Synchronization Orchestra Recording Music and Dialogue for a Talking Cartoon; the Conductor Watches the Screen and Times His Baton to the Action on It

the filming room to be "shot." The camera is suspended over a table. The robot actors, face up, are placed beneath the lens and photographed in their various poses and moods. Frame by frame, the photographer records their pictures. This method of grinding out film is much slower than the ordinary one used on moving-picture lots. Four cameramen turn out only 1,000 feet of animated movies each week. That means each operator can film only five feet per hour. The finished reel is 1,000 feet long, but one-third of this footage is cut out in editing. Hence, the seven-minute reel shown in the theater measures between 600 and 700 feet, costing from $20 to $30 per foot.

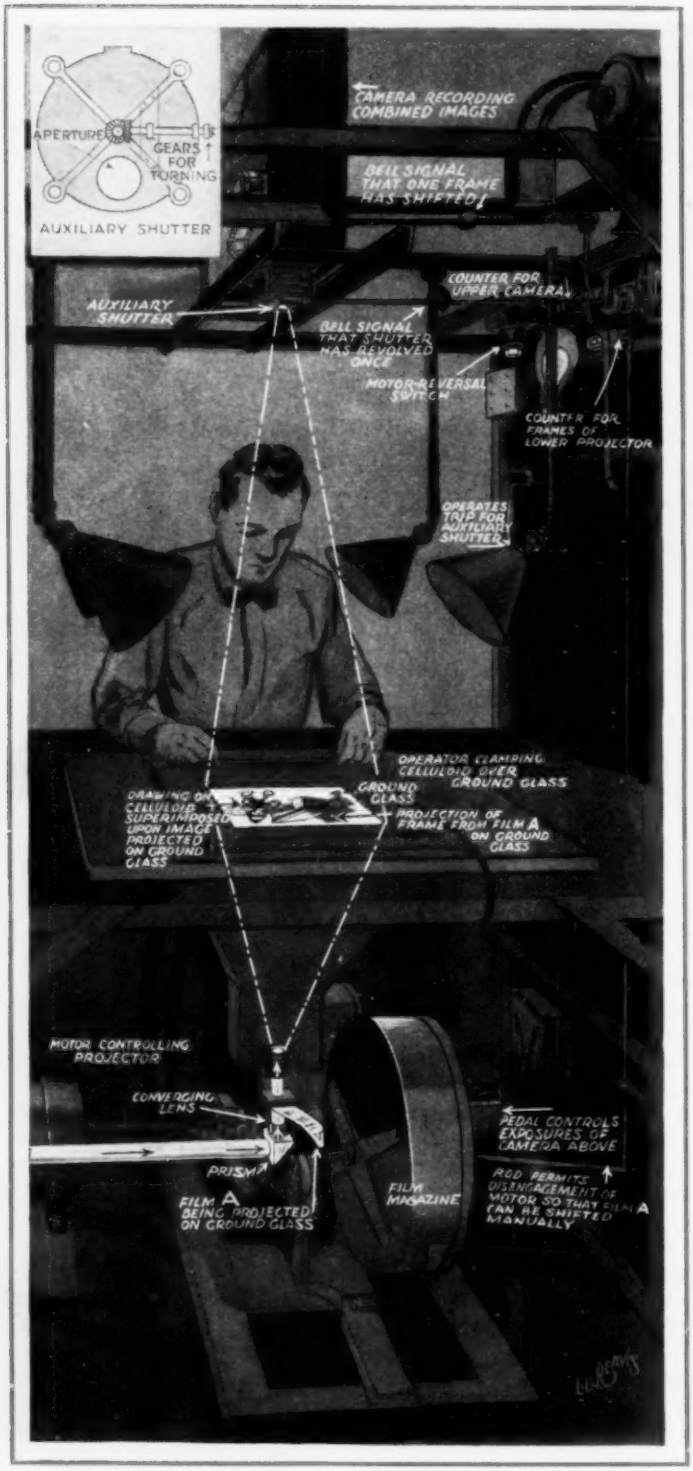
The United States is the home of the animated cartoon and at present practically monopolizes production. Windsor McKay, the cartoonist, is said to have made the first successful effort at causing hand-made pictures to move across a screen, but he never patented the idea, so that now the basic principle is used freely by half a dozen studios whose yearly productions average about 150 reels.

In the synchronization department, the orchestra conductor and his musicians follow the cue sheet and interpret in tunes and dialogue what the cartoonist has imagined. Using hundreds of queer contraptions, the "effects men" can simulate the laugh of the Moon, the gurgle of a brook, the fall of rain, the noise of a comet, the roar of a locomotive, the dance of a snail and the sneeze of a walrus.

Among the studio's domestic hardware one finds sandpaper, tinfoil, washboards, toy trains, bricks, bats, building blocks, egg beaters and electric fans. The orchestra leader faces a screen across which the robot actors jump, walk and dance. His musicians face him and follow his directions at the precise moment.

The popularity of film funnies is explained by one producer who paraphrases the old Chinese proverb: "A good cartoon is worth a thousand words." At a time when cartoons were "stills" and consisted of only one drawing, the old proverb held good. But now that cartoons are animated and it takes 8,000 of them to complete one film, the producer argues that one reel is worth 8,000,000 words.

A leading animated-cartoon producer


APERTURE
GEARS FOR TURNING
AUXILIARY SHUTTER
CAMERA RECORDING COMBINED IMAGES
BELL SIGNAL THAT ONE FRAME HAS SHIFTED
COUNTER FOR UPPER CAMERA
AUXILIARY SHUTTER
BELL SIGNAL THAT SHUTTER HAS REVOLVED ONCE
MOTOR-REVERSAL SWITCH
COUNTER FOR FRAMES OF LOWER PROJECTOR
OPERATES TRIP FOR AUXILIARY SHUTTER
OPERATOR CLAMPING CELLULOID OVER GROUND GLASS
GROUND GLASS
DRAWING ON CELLULOID SUPERIMPOSED UPON IMAGE PROJECTED ON GROUND GLASS
PROJECTION OF FRAME FROM FILM A ON GROUND GLASS
MOTOR CONTROLLING PROJECTOR
CONVERGING LENS
PRISM
FILM A BEING PROJECTED ON GROUND GLASS
FILM MAGAZINE
PEDAL CONTROLS EXPOSURES OF CAMERA ABOVE
ROD PERMITS DISENGAGEMENT OF MOTOR SO THAT FILM A CAN BE SHIFTED MANUALLY

Making One of the Pictures That Compose a Cartoon Comedy

says that the robot is tending to become more and more simple in his make-up. The present trend, he thinks, is toward more imaginative action. The cartoonist aims to give us impressions of the life around him, not illustrations of it. The imaginative picture is impossible any other way.

Movie cartoonists have made capital of the fact that animals have an intense human appeal. Bimbo and Mickey, two famous characters born in inkwells, are now better known than a good many actors in the flesh. A picture of Bimbo would be as readily recognized in China as in the United States.

The role of the artist becomes more and more important as the film funnies achieve greater popularity. In forthcoming productions more artists will be necessary, since no machinery so far invented can make a cartoon actor go through his antics.

INSULATION FROM CORNCOBS

Ordinary corncobs, treated with acids and put through simple converting processes, have been found to be effective in the making of electrical insulators. The corncob product resembles bakelite, is plastic and is resistant to chemical as well as electrical action. Iowa State College holds the patent on this development, which may mean much to farmers in the corn belt.

Architect's Drawing of the Building Which Will House the Basic and Medical Science Exhibits at the Chicago World's Fair in 1933; It Will Stand on the Shore of Lake Michigan

GREAT PROGRESS OF MEDICINE TO BE SHOWN AT FAIR

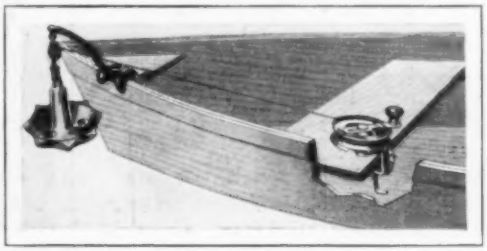
Architects' drawings recently were completed for the building which will house the basic and medical sciences at the Century of Progress Exposition in Chicago in 1933. The large structure will cost $683,000 and will stand on the shore of Lake Michigan, the water and a graceful corner tower combining to offer possibilities of effective night illumination.

YEARLY FOOD BILL OF INSECTS WOULD BUILD NEW FLEET

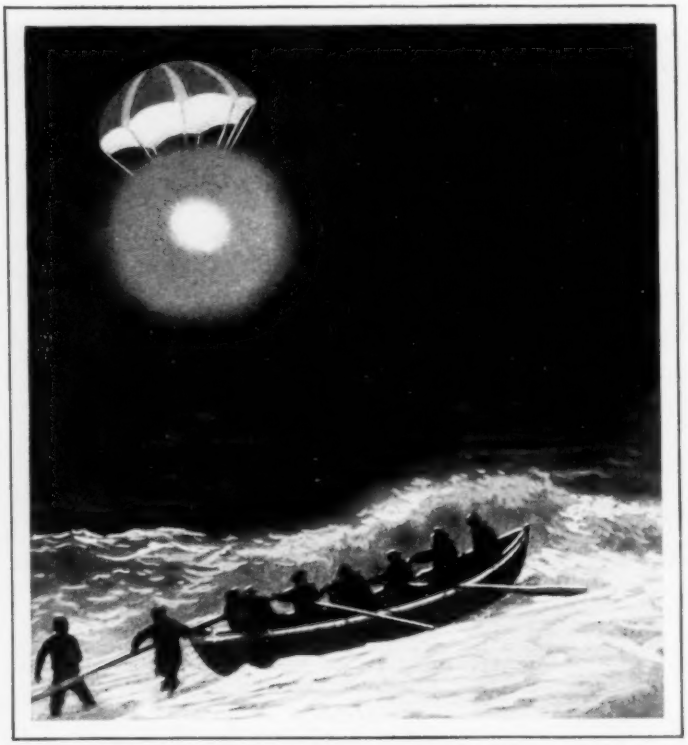
More than $900,000,000—enough to replace every battleship in the navy and have quite a lot left over for cruisers—is the annual food bill of the major insect pests of the United States. This sum has been fixed by the department of agriculture from estimates of damage done by thirty-four of the more important of the many-legged enemies of man's crops, forests and manufactured products. This covers only a small number of species, although it includes the most harmful ones. However, there are about 6,000 species on record as of economic importance, and it is estimated that if it were possible to obtain figures on all the mischief done, the total might be near $2,000,000,000. The biggest bugbear is the cotton boll weevil whose dinner check comes to $164,500,000. Next comes the cotton boll worm whose damage is estimated at $104,000,000 to cotton, corn, tobacco and tomatoes.

BOAT ANCHOR AND HOIST ARE QUICKLY INSTALLED

For the rowboat or other small craft, a combination anchor and hoist is offered that is quickly installed and as quickly detached. It consists of a clamp to which a pulley for the anchor line is attached, and a drum for winding the line. The drum can be clamped to a seat and the pulley to the side of the boat in less than a minute. The hoist weighs only four pounds and the anchor twelve. A catch holds the anchor at any depth desired and thirty-five feet of cable are provided.



Combination Anchor and Hoist for Small Boat That Is Quickly Installed or Detached



Use of Parachute Flare in Launching Boat; It Gives Better Visibility for a Longer Period than a Rocket

PARACHUTE FOR MARINE FLARE INCREASES VISIBILITY

Increased visibility for marine distress signals is offered in an aerial light to which a parachute is attached. The flare is in cartridge form and is fired by a signal pistol. At about 200 feet it hangs suspended over the boat by its parachute. The signal, of 30,000 candlepower, can be seen for a distance of twenty-five miles, and longer than rockets.

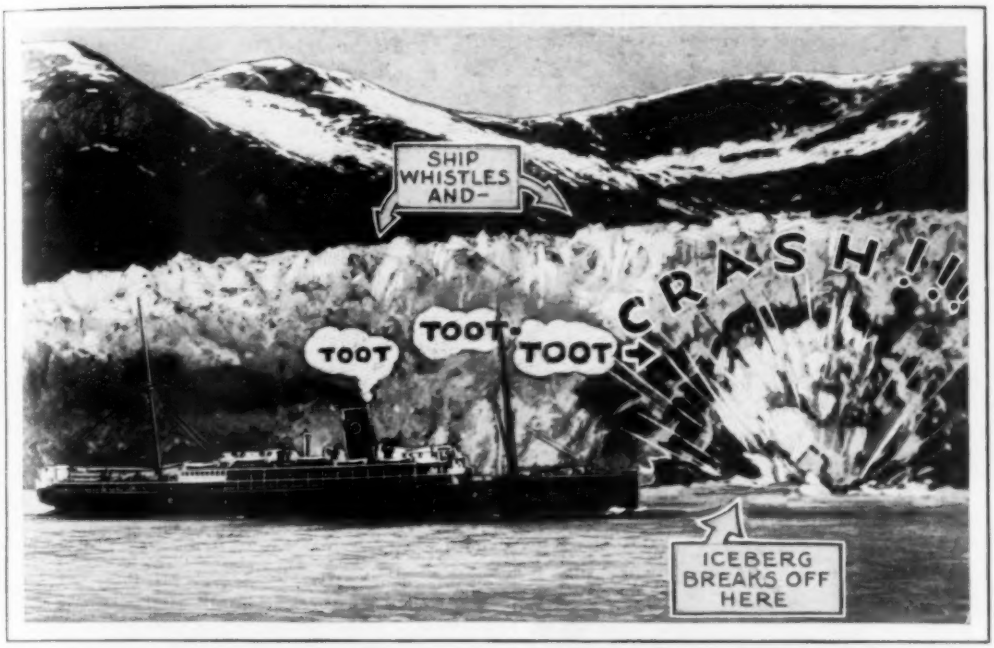
USING A LOW-TEST GAS IN H. C. MOTORS

Motorists who habitually use special anti-knock gasolines to run their high-compression engines can get along with ordinary grades of fuel, providing they retard the spark. According to research findings at the University of Michigan, no variation in gas or spark control can obtain better results in a high-compression motor than anti-knock fuel and a well advanced spark. But when, by preference or necessity, ordinary gasoline is used, retarding the spark will get results at least equal to the best obtainable with low-compression motors. Retarding the spark reduces the force of detonation or knock. In the course of their experiments, University of Michigan students have discovered that a small amount of engine knock does not always mean decreased power. However, when knocking becomes severe, power drops off rapidly.

RADIO-OPERATED WASHER TREATS TONS DAILY

London now boasts a radio-controlled washing machine. One laundry is equipped with a huge washer that is started and stopped by means of wireless amplifiers. The washer is capable of handling 1,000 pounds of clothes an hour, or some four or five tons a day.

Washing Machine That Is Started and Stopped by Wireless Amplifiers and Handles 1,000 Pounds of Clothes an Hour



How a Glacier Is Cracked by a Blast from a Steamship's Whistle; Seamen Claim Whistles Tuned to a Certain Pitch Set Up Sound Vibrations Which Loosen Blocks of Ice

ICEBERGS BROKEN BY WHISTLE FROM PASSING SHIP

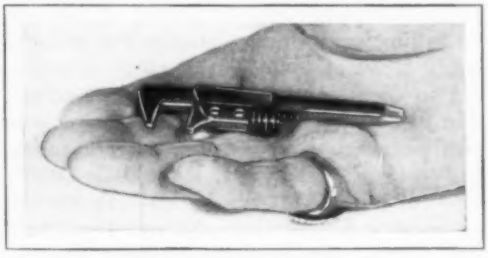
Steamships on the Pacific coast are indulging in the sport of smashing icebergs with blasts from the boats' whistles. Officials of some of the vessels claim that scientifically pitched blasts from the whistles set up vibrations in the face of the famous Taku glacier, loosening huge blocks of ice which crash into the sea. Some of the steamship companies believe they have found the exact whistle tone which causes the icebergs to break.

DOOM OF NOBLE CAVALRY SEEN IN FUTURE WARFARE

Thundering, thrilling cavalry charges will have no place in future warfare. Baby tanks and armored cars, roaring over shell-torn ground, will do the job that once belonged to the spectacular horsed troops, according to Gen. Douglas MacArthur, chief of staff of the U. S. army, who believes that the next war will see horses relegated to a minor part, while swift tanks and cars, equipped with heavier guns than cavalry could carry, speed into the thick of battle. Only the air forces will go ahead of the "horseless cavalry." Light armored cars have been developed which can travel at sixty miles an hour and carry armament far in excess of the best ordinary cavalry equipment. Horses, once considered as "weapons" in themselves, will have only humble tasks to do behind the battle fronts.

TINY WRENCH FOR FINE WORK IS ALSO A SCREWDRIVER

So small that it can easily be concealed in the hand, a tiny adjustable monkey wrench is intended for making repairs to the radio and sewing machine, or for other fine work. The end of the handle tapers to form a screwdriver.



Tiny Monkey Wrench for Fine Work; the Tip of the Handle May Be Used as a Screwdriver

PUZZLE PLANT FOUND GROWING IN BURBANK'S GARDEN

Spear-Shaped Plant in Garden of the Late Luther Burbank Which Is a Puzzle to Botanists

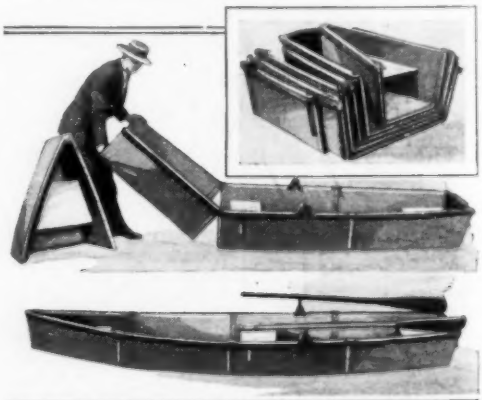
Carrying on the work of the late Luther Burbank, plant wizard, is proving no easy task for botanists, because each year his California garden sprouts a lot of new plants concerning which he left no notes and whose characteristics are difficult to determine. One of the puzzles is a pink-flowered, spear-shaped odorless plant that grew from a tiny shoot to a height greater than a person's in the space of a few months. As yet, botanists have been unable to classify the phenomenon.

BITTER TASTE STILLS HUNGER AND SWEET INCREASES IT

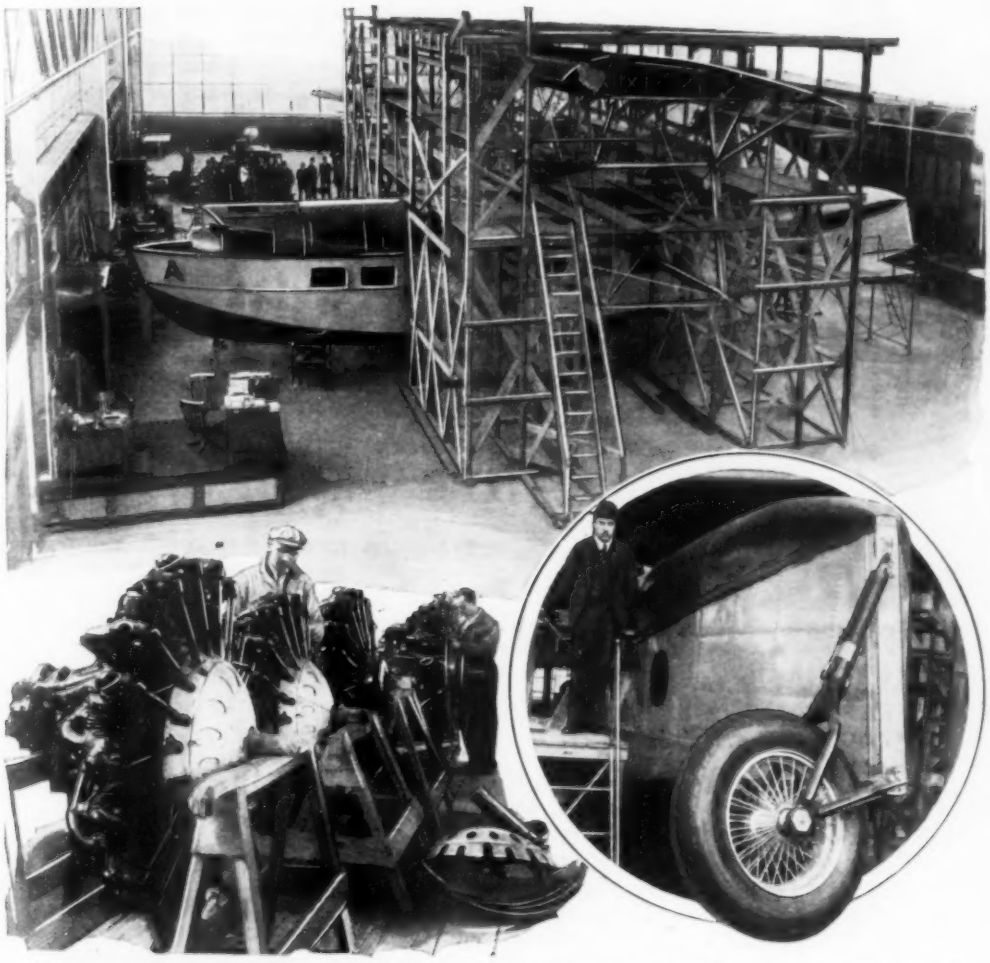
Hunger pangs can be staved off merely by taking something bitter in the mouth, while a sweet taste is the most effective aid to digestion. These and other scientific effects of the mere flavor on digestion were reported recently after a series of investigations by Dr. Donald A. Laird, director of the psychological laboratory of Colgate University. Sweet, sour, salt and bitter, the four elementary savors, were produced in the mouths of students without any of the taste substance entering the stomach, and were found to affect stomach contraction, flow of saliva, gastric digestion and even breathing. Not all affected the digestive processes to the same extent and in the same direction, but sweet and salt in general produced the most favorable results. All elementary tastes stop the hunger contractions of the empty stomach as soon as the substances are placed in the mouth, this inhibition lasting as long as the taste remains, but bitter and sour effects sometimes continue for fifteen minutes. Sweet and sour increase saliva flow, and salt and bitter give no noticeable variation from normal. Sweets during the meal or immediately afterward boost gastric secretion, salt raises it less and bitter seems to have no effect. Sweet deepens breathing while sour causes restrained breathing, and salt results in a distortion as though the subject were gasping for air.

SECTIONAL BOAT TAKEN APART OR ASSEMBLED QUICKLY

Assembled or taken apart and folded up in five minutes, a sectional boat is designed for packing into a comparatively small space in a car or other conveyance. The ends of each section are open, so there are no obstructions in the craft after it is assembled. Each part rests in another one, and the dimensions of the knocked-down boat are only forty-two by twenty-eight by sixteen inches. When assembled, any make of outboard motor can be attached to the craft with safety.



Sectional Boat Which Can Be Assembled or Taken Apart for Transporting in a Few Minutes



Above, View during Construction of One of the Forty-Six Passenger Amphibians for Pan-American Airways; Below, Left, One of the Engines for the Ship, and, Right, the Tail

HUGE AMPHIBIAN WILL CARRY FORTY-SIX PASSENGERS

Huge amphibians soon will be in the service of the Pan-American Airways for the West Indies and South American traffic. The first of these great ships recently was assembled at Stratford, Conn., and will carry forty-six passengers and its crew, being the largest craft of its kind in the world. This plane is powered by four motors and is expected to attain a maximum speed of 129 miles an hour. The wing spread is 114 feet.

HEAVIER AND STRONGER RAILS FOR TRAIN SERVICE

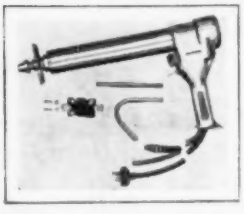
Rails, heavier and stronger than ever before, are now being rolled for regular service on one eastern railroad. The new section weighs 152 pounds per yard as compared with the former 130 pounds, and is a result of two years of intensive study by rail and steel company officials. Although only twenty-two pounds heavier, the latest rail is seventy-five per cent stronger than the standard ones now used. This rail will be employed only where traffic is very heavy. Elsewhere another rail, which is only one pound heavier but twenty-two per cent stronger than the present standard, will be used.

Form of Gold Separator Which, It Is Claimed, Will Do the Work of More Than 1,200 Men

GOLD SEPARATOR TO DO WORK OF OVER THOUSAND MEN

Two California inventors have built a gold separator which, they claim, will do the work of 1,250 men. The simple device, the makers assert, will wash 100 cubic yards of gravel in a half-inch stream of water, whereas, under the old system, it would require more than 2,200 tons of water to do the job. It is also claimed the separator eliminates all the gold from any amount of gravel run through it.

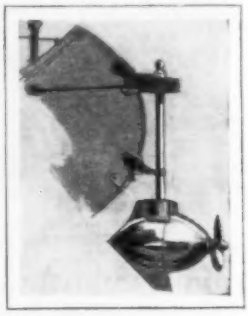
GUN SPRAYING HOT OIL CLEANS AUTO TRANSMISSIONS



For quick cleaning of automobile transmissions and differentials, a gun that sprays hot liquids and hot air is being offered. It contains a heating element and works on virtually any air pressure. To operate, it is only necessary to insert the proper nozzle, fasten the air line to a compressor outlet, plug in the electric connection, place the suction hose in the kerosene, oil, water or other liquid, and pull the trigger. This trigger automatically opens both air valve and electric current, and neither will stay on when the trigger is released. It can be used to shoot hot liquid or hot air only, or for cold liquids and air. It has been found that the hot kerosene or hot oil penetrates and mixes better with lubricating compounds than steam or cold liquids. The gun will blow a stream of hot liquid and air at a temperature ranging from 150 to 250 degrees, depending on the material used. The outfit also can be used to clean engine blocks, wire wheels, springs, crankcases and gears.

CANOE EQUIPPED WITH MOTOR OPERATED BY BATTERIES

Electric power is now available to operate the canoe, small rowboat or tender. A canoe is being offered which is propelled by an electric motor driven by two six-volt batteries. It averages about seven miles an hour and will operate for about eight hours on a full charge. It is recharged overnight by connecting a recharging unit to an ordinary lamp socket. Similar installations are available for other types of boats. The motor is submerged, and the batteries rest under the seats below the water line. These features, together with air pontoons, make the craft much safer than the ordinary canoe and less likely to capsize.



COST OF AIRPLANES DROPS AS SIZE INCREASES

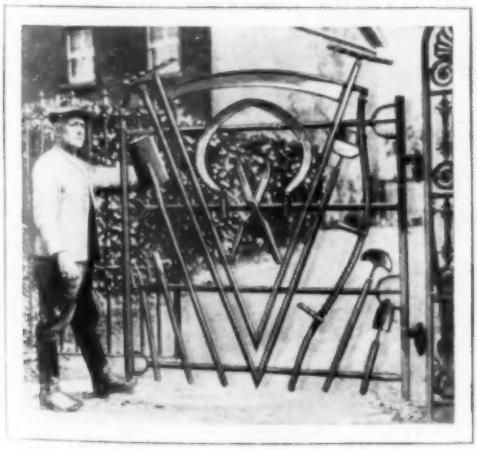
Cost of constructing airplanes decreases proportionately as the size of the craft increases. This fact has led the national advisory committee for aeronautics to conclude that extra-light ships of very small size probably will disappear from the market eventually. Monoplanes have been found cheaper to build than bi-

planes, all-metal construction is much more expensive than mixed construction, and multi-engined craft are more costly than single-engined types of the same capacity and speed. The cost also is always increased by safety requirements. The main items in construction are labor, general expenses and materials, but it has been found these three factors vary greatly in different factories, or even in the same factory under different conditions. From the cost data it is concluded that sport ships should be kept above a certain minimum size limit, as any further reduction is unlikely to bring advantages.

Man Taking Vision Test before an Apparatus Which Measures Nerve Reaction, Recording Alertness of Mind and Precision of Movement

GATE MADE OF GARDEN TOOLS AT ENTRANCE TO FARM

One English landowner has fashioned a gate made entirely of farming and gardening implements to mark the entrance to his farm. Included in the array of tools are spades, scythes, rakes, trowels and many other familiar implements, symmetrically arranged to form an effective but attractive barrier.



Gate Made of Farming and Gardening Implements, Arranged to Form a Symmetrical Design

NERVE REACTION IS MEASURED IN SAFETY TESTS

Employes of the elevated railway lines in Chicago are being subjected to tests by intricate machinery that virtually reads their minds as a means of increasing safety and efficiency. Technically, the apparatus is called a nerve-reaction machine. It records alertness of mind, precision of motion and movement, extent of carefulness and degree of muscular fatigue of the person taking the test.

AIR IN TRAIN IS CONDITIONED FOR TRAVELERS' COMFORT

One eastern railroad has placed in service a train in which every passenger coach is equipped with an air-conditioning system. Smoking lounge car, observation car, parlor cars, individual seat coaches and diner, all are air-cooled and air-purified. The apparatus not only regulates the temperature of the air entering the cars, but also controls its humidity and cleans it, then circulates the current of clean, cool air without creating drafts. Temperature is controlled by a thermostat, and the equipment functions when the train is standing still as well as when it is running. Thus passengers can remain comfortable in the hottest weather.

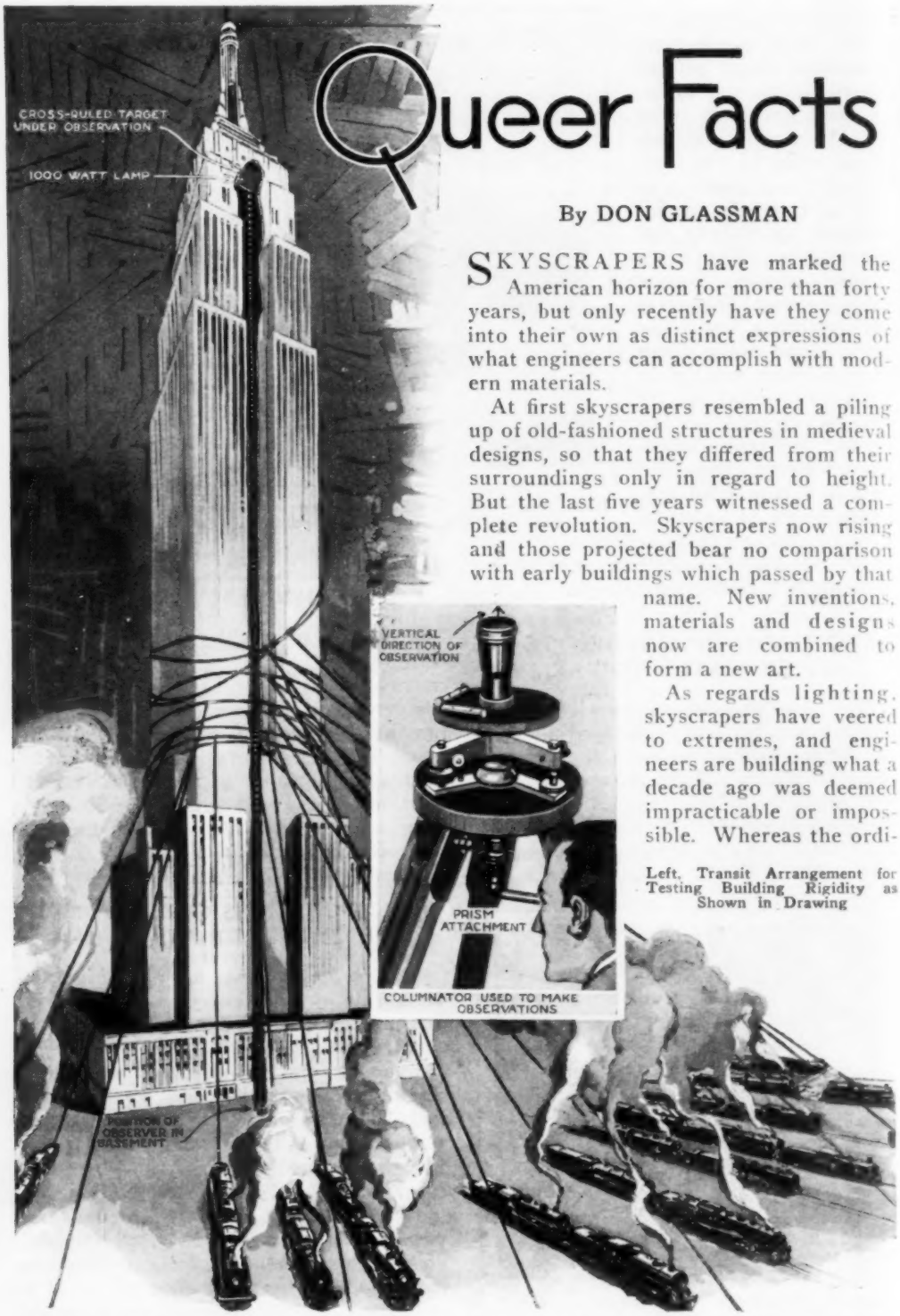
Queer Facts

By DON GLASSMAN

SKYSCRAPERS have marked the American horizon for more than forty years, but only recently have they come into their own as distinct expressions of what engineers can accomplish with modern materials.

At first skyscrapers resembled a piling up of old-fashioned structures in medieval designs, so that they differed from their surroundings only in regard to height. But the last five years witnessed a complete revolution. Skyscrapers now rising and those projected bear no comparison with early buildings which passed by that name. New inventions, materials and designs now are combined to form a new art.

As regards lighting, skyscrapers have veered to extremes, and engineers are building what a decade ago was deemed impracticable or impossible. Whereas the ordi-



Left, Transit Arrangement for Testing Building Rigidity as Shown in Drawing

Rigidity and Strength of Empire State Building Are Demonstrated in Spectacular Fashion Above; Forty Locomotives Pulling Simultaneously Could Sway It Only Fraction of an Inch

About Skyscrapers

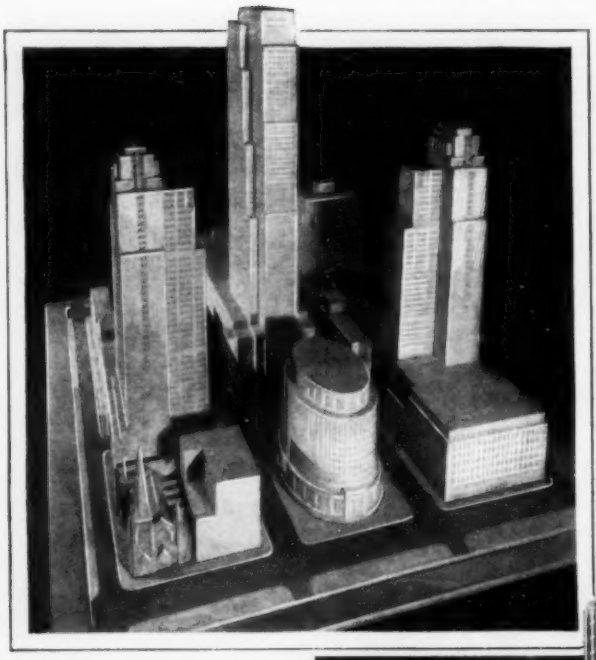
Window Cleaners at Work on Some of the 12,800 Panes of Glass in the Empire State Building, the World's Tallest Skyscraper

nary skyscraper has about one-third of its exterior walls devoted to window space, the most recent designs show as much as ninety per cent devoted to windows—in other words, a building whose walls are windows; on the other hand, windowless skyscrapers also have come into vogue. Each type of skyscraper is planned for a specific purpose.

In planning and erecting modern skyscrapers, architects and engineers have amassed startling new facts and have observed mysteries as well. One of the great mysteries concerns the effect of wind on high buildings. It must be plain to everybody that if wind can drive a ship and uproot a tree, it also exerts tremendous force against a building. The higher the building, the more wind-bracing necessary. Now the amount of steel needed to brace a skyscraper against the wind mounts, as in the case of the Empire State building, to hundreds of tons. The actual resistances are calculated on paper, since no experimental method has yet been devised of measuring the wind's force against a skyscraper.

So far, the sway of a building in the wind has been measured accurately in very few cases. The forty-eight-story tower of the American Insurance Union building, in Columbus, Ohio, was found to sway one-half an inch in a thirty-eight-mile wind. Another skyscraper leaned backward, that is, in the direction from which the wind blew, and the only way engineers could explain this mystery was by blaming the sun, which caused one side of the building to expand more than the opposite side.

H. G. Balcom, a consulting engineer, who has designed towers for America's highest skyscrapers, says that the Empire State is built to withstand a total wind pressure of 4,340,000 pounds on the north and south sides, of which 318,000 represent the pressure against the mooring



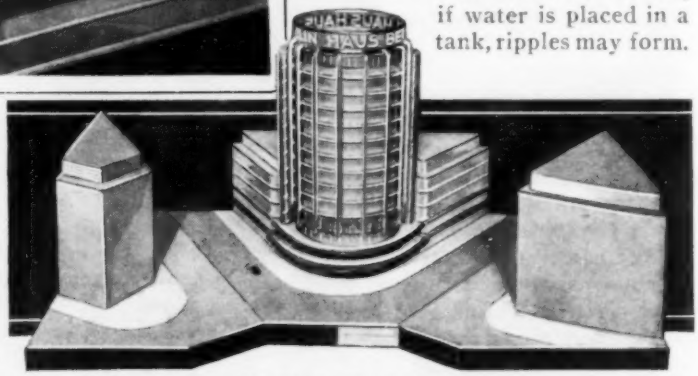
mast alone. The design provides for a safety factor which probably doubles the strength of the building, so that this colossal skyscraper could remain immobile in the face of a 100-mile gale, practically as rigid as a mountain. Indeed, if forty high-powered locomotives were chained to the Empire State and made to pull with all their strength, they could not budge the building more than an inch. Mr. Balcom explains that this 1,250-foot giant presented no complications in the matter of bracing, because it is not extremely high in comparison with the area of its site. All columns are braced in both directions.

In planning narrow and high skyscrapers, the problems of wind-bracing bring nightmares to engineers. In some instances, fifteen per cent more steel is required because the tower is very high in comparison with the area of the foundation.

"The Empire State might have gone twenty stories higher over the same site without taxing the steel framework," Mr. Balcom went on, "but if future skyscrapers are to rise one-half a mile high, the promoters had better find large lots. The ratio of width to height is a vital factor in wind-bracing. If you build twice as high, the columns must be twice as strong. At present we design buildings five to ten times higher than the maximum dimension of their sites. The Empire State is only six times higher than its foundation is long.

"On a one-half-mile building there would be a much broader sway than on present buildings. But since structural steel is elastic, the leaning tower would spring back into place."

No man ever saw a skyscraper move. But one may see evidences that it moves. To wit, if water is placed in a tank, ripples may form.



Above, Model of New York's "Radio City," Showing Mass Arrangement; Below, Somewhat Similar Grouping of Units Planned for Berlin

Lighting fixtures of a certain length will swing; the fixture moves if its period of oscillation is in exact time with the building's swing, but if you lengthen or shorten the suspension, the fixture will cease to swing.

Temperature variations may change a building's dimensions, although the factor of temperature is rarely considered by construction engineers. Observers have noticed that the "needle" on the Chrysler tower frequently seems to lean. The explanation is that the sun heats up one side of the needle and causes it to expand, while the opposite side remains comparatively cool. Thus when spectators remark that the needle is leaning, they are technically correct.

Many mysteries surrounding the sway of skyscrapers will shortly be investigated

Fifty Years of Progress in Architecture; Above Is the Skyline of Lower Manhattan as Seen in 1876, and, Below, Is a Recent View of the Same Area Taken from the Brooklyn Bridge

by a group of engineers, aided by apparatus installed in the vertical fire shaft of the Empire State building. An observer stationed at the bottom of this dark shaft will sight on a small electric light hanging from the top. The least shift of the light will be recorded on the cross hairs of a telescope lens. The observer will go on duty only when the weather forecaster predicts a brisk or unusually high wind.

Ingenious ideas in skyscraper design and construction will be placed into practice when John D. Rockefeller's "radio city" rises on a site of three huge square blocks near the heart of New York city. This $250,000,000 project leaves us breathless when we consider the colossal quantities of material involved. First, it requires a steel order of 125,000 tons, by far the largest ever placed. To provide adequate foundations, more than 600,000 cubic yards of soil and rock will have to be excavated.

Radio city will consist of both high and low buildings. The central skyscraper will be windowless for the first fifteen stories, but above that windows will open to the air. The buildings are so arranged with reference to one another that they will not interfere with natural lighting, although it is apparent that the whole city could be built without the least dependence upon natural light and air. Modern lighting and ventilation systems make

windowless buildings possible. Even so, the inhabitants of radio city will have 25,000 windows.

The fifteen windowless stories in the main skyscraper are designed for the National Broadcasting company, whose activities suffer from outside noise interferences. The company's radio studios and offices will be completely insulated. A system of air conditioning will cool the atmosphere in summer, heat it in winter and determine the right amount of moisture at all times. Broadcasting activities will center around twenty-seven soundproof studios. They will be rooms within rooms, the inside ones suspended from the ceilings of the outside ones. Studio windows will have triple panes of glass set in rubber, and the doors will be leaden, two and one-half inches thick.

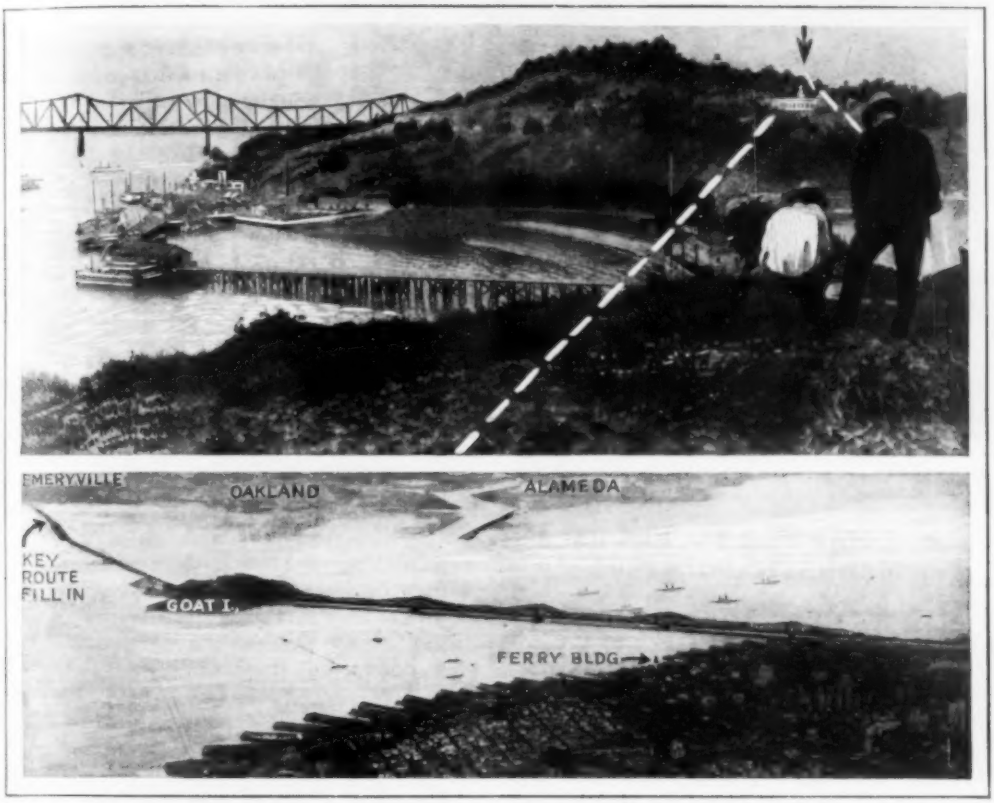
Underground, the buildings in radio city will be accessible from all parts by a system of subterranean viaducts. Tenants will have parking space for their cars, and special platforms will take care of truck deliveries. The underground corridors will be lined with restaurants, barber shops, and stores of all kinds. A huge subway station will bring people from all parts of the metropolitan area.

Today, property owners are beginning to realize the high cost of natural light for congested areas. The fact is, sunlight costs as much money, in some cases more than artificial illumination. Windows are more expensive than blank walls; they decrease the usable wall space; they increase heating costs; their washing adds to the expense of building maintenance; they admit disease germs and dust, both items costly to the health of people. Another great advantage of windowless buildings is that they eliminate light courts, and thus enable property owners to double their rentable floor space. Mercantile establishments and offices have also come to know the advantages of carrying on their activities without outside interference. Windowless buildings protect them from the traffic roar.

© Fairchild Aerial Surveys

Aerial View of an Imposing Monument to the Architectural Genius of Modern Man, the Empire State Building, the World's Tallest Skyscraper, Surmounted by Its Dirigible Mooring Mast

BRIDGE OVER FRISCO BAY TO GO THROUGH TUNNEL

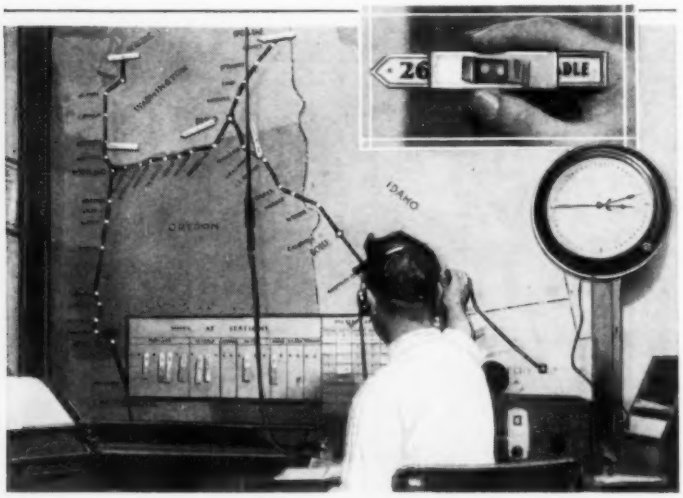


Above, Goat Island, in San Francisco Bay, Showing Path across Island the Bridge Will Follow; Below, Aerial View of the Bay, Giving the Route of the Long Span

San Francisco and the cities of Berkeley, Alameda and Oakland are to be joined by a bridge across San Francisco bay that in many respects represents feats new to bridge construction. It will be the highest span over tidewater, towering 500 feet at its pinnacle, and will cost $72,000,000. Four main spans and the necessary approaches will reach from San Francisco for a distance of 8,600 feet to Goat island in the bay. Here the roadway will extend for a distance in a tunnel, then emerge to leap a subsidiary channel on a single 750-foot span, continuing eastward on a steel trestle to Oakland. The spans will have a 200-foot clearance at high tide.

"BALL COURTS" OF ANCIENTS FOUND IN MEXICO

Two ancient Indian cities, never before visited by archæologists, were explored recently by a Mexican scientist who has found that they preceded the Aztec period. These two sites, Toluquilla and Ranas, are some twenty miles apart in the Sierra Gorda mountains of Queretaro. They are veritable fortresses built on precipitous cliffs whose only approaches are defended by double and triple walls of enormous thickness. The abandoned cities were found covered with dense vegetation, but exploration showed they probably were built by the Toltecs, a people which antedated the Aztecs and were the conquerors of the famous Mayas of Yucatan. Each city had two great "ball courts," inclosed by stone walls. Among the finds were beautiful sculptured stone yokes, believed to have been used to weight the victim's neck in human sacrifice.



Galvanized-Iron Map of an Air Route with Magnetic Arrows Attached to Show Position of Each Pilot as He Proceeds over Course

IRON MAP FOR FLYERS USES MAGNETIC POINTERS

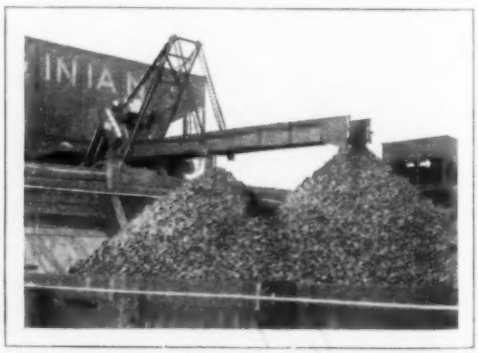
Magnetic arrows have solved the problem of keeping constant check of the position of all the airplanes of one transport company. A galvanized-iron map of the territory was made, and small magnets were placed on the backs of arrows, each marker bearing a pilot's name and the number of his ship. In this manner the path of each plane is followed on the map by moving the magnetized arrow.

SECRET OF DEW POND KNOWN TO ONLY TWO MEN

Dew ponds, those artificial pools in England that apparently hold an inexhaustible quantity of water and seem to supply stock when all other means fail, are a source of considerable mystery. It is said the secret of their construction has remained in one family for generations, and that today only two men know it; and they are under oath not to reveal it to others. These two brothers dig out a hole to a depth of about five feet, the sides sloping upward to the surface where they are banked about eighteen inches above ground level. The pond is lined with clay and the clay is covered with straw which in turn is covered with lime, the latter ingredient being kept carefully from coming in contact with the clay. A secret substance is then mixed with the lime, and earth is placed over all and packed down to form the bed of the pond. This finishes the job and it only remains for the pond to fill. Once filled, the pool apparently never runs dry, regardless of how prolonged the periods of drouth may be. The accepted scientific explanation is that the layer of straw insulates the earth below and prevents heat passing from it to the water. The water, therefore, remains cold and causes the moisture-laden night air to part with its water, thus replenishing the pool. The heat of day causes evaporation and this increases the coldness and further facilitates condensation. Many persons have tried making dew ponds, but have never succeeded

ONE-MAN COAL-CAR UNLOADER SPANS TRESTLE TRACKS

Handling a ton of coal a minute, a car unloader for trestle tracks combines an



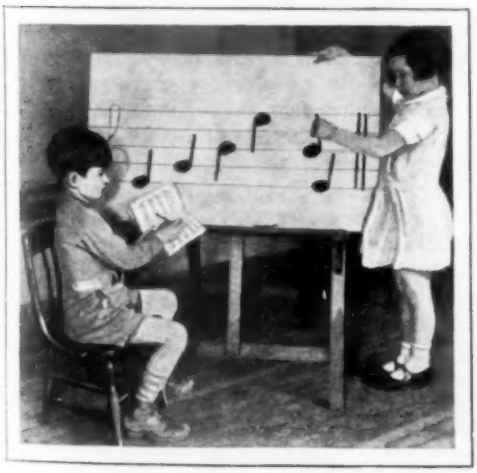
One-Man Coal-Car Unloader for Trestle Tracks, Consisting of Unloading Unit and Conveyor System

unloading unit and a conveyor system in such compact form that it can be operated easily by one man. The machine is run either by a ten-horsepower gasoline engine or a seven-and-one-half-horsepower electric motor. It will build a pile fourteen feet high if worked in a level

yard, and when worked from a trestle track increases storage capacity from five tons per foot of height to fifteen tons. The unloader is mounted on a narrow-gauge industrial track paralleling the railroad track at the same height, the former track being built on the railroad embankment or a trestle alongside. In level yards, one man can push the machine on its track and swing it into position with the unloader end under the hopper car. The long, wide conveyor pan receives the discharge from the hopper and empties it into the twenty-foot flight-conveyor boom, the flights on which travel faster than those on the unloader to prevent clogging. For building up storage piles, the boom has a hoist and cable so it can be lowered or raised.

MUSIC NOTES HUNG ON WIRES AID CHILDREN IN STUDY

Music notes suspended on wires, formed to represent the conventional staff, are being employed in one New York school as an effective method of training children in musical appreciation and composition. The movable notes on the wire staff have been found to attract and hold the interest of the pupils and to arouse their creative instincts.



Movable Music Notes, Suspended on Wires Formed to Represent the Staff, Aid in Teaching Children

Rare Flowers Grown by an Officer of the "Leviathan"; They Apparently Thrive on the Sea as Well as on Land

OCEAN-GOING FLOWERS THRIVE ON BOARD "LEVIATHAN"

One of the officers of the "Leviathan" grows rare flowers as a hobby aboard the huge liner as she makes her regular trips across the Atlantic. When not on duty, he gives painstaking care to his ocean-going garden, which includes tulips and Dutch bulbs that have crossed the ocean many times.

LONDON NOW ONLY FIVE HOURS FROM ROME BY AIR

When Capt. Frank Hawks, American aviator, flew from London to Rome recently in five and one-half hours, he performed a feat that less than a century ago would have been considered a miracle. For 400 years this route has been one of the busiest, most uncertain in the world. A history covering journeys between these two cities probably would take in many important world events. Constantine made it when he was proclaimed emperor. He kept no diary of his travel, but there is an authentic record, 1,500 years later, of a forced journey from Rome to London made by Sir Robert Peel when he was summoned by King William IV to become prime minister. Traveling day and night and using every facility at his disposal, he was able to present himself before the king just thirteen days after leaving Rome. Of these there were only four when he was not traveling all night.

New Wings for

Army's Newest Low-Wing Plane with Its Wide Tread for Safety in Landing; Note the Retractable Landing Gear; the Wheels Can Be Raised or Lowered in Only Fifteen Seconds

UNCLE SAM is preparing to move his army air squadrons across the continent twelve times faster than storms can gather to impede the progress of a combat force flying from the Atlantic to the Pacific.

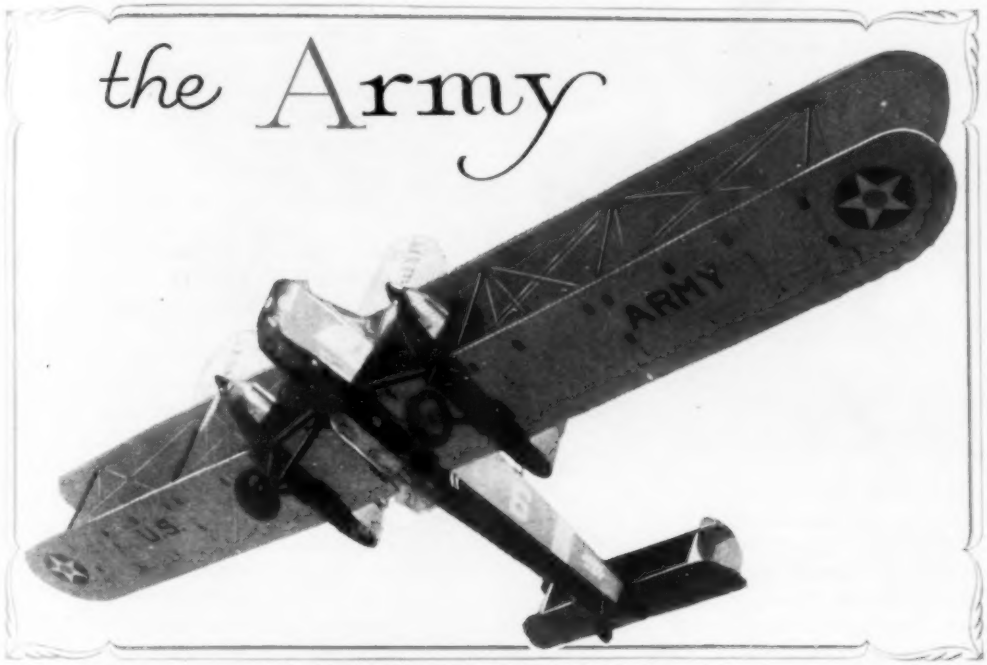
Each streamlined metal monoplane, with an engine more powerful than any yet used in fast military planes, and capable of speeding 300 miles an hour with the wind, will be able to carry seven men or two 500-pound bombs across the continent faster than the world's speediest pursuit planes can fly.

The newest combination transport and bombardment low-wing monoplane, tapering from a blunt nose which houses a streamlined engine, to the tiny light at the tail, literally cuts through the air like a giant knife. Its wheels fold up into the underside of the big wing. This plane can pick up a bomb weighing 2,000 pounds and carry it to an altitude of more than three miles. Without a heavy load, the plane can carry a pilot and observer up to an altitude of five miles.

With its new wings, some of which remain in experimental stages, the army will be able to move its combat squadrons 200 miles an hour across the continent. With them experienced weather men will fly to receive reports from department of commerce ground stations and issue hourly weather forecasts to the flight leader.

If 100 army planes, flying at that great speed, were to start tomorrow morning across the continent, they probably would encounter two or three storms before nightfall. Although the planes would be flying as far in an hour as a storm would move in twelve hours, the weather man will be able to direct them around the threatening areas. A storm in Kansas today may move into the Ohio valley tomorrow, covering a range of 360 miles. Capt. Ira S. Eaker, famous army long-distance flyer, recently flew an all-metal army monoplane with a heavy tail wind almost that far in one hour.

Now the army wants to know more about storms, especially as some of its planes are achieving great speeds. Its aerial forces, in moving long distances, want to take advantage of tail winds, yet do not want to run into storms. That's where the weather man comes in. As faster planes enter army ranks for pursuit, attack, observation and bombardi-



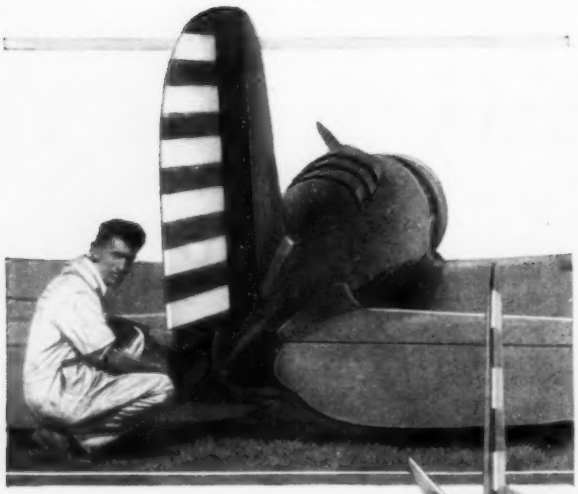
One of the Army's Big Twin-Engined Bombardment Planes, Which Has a Wing Spread of Ninety Feet and Carries under Its Body a Deadly Bomb, Weighing 4,000 Pounds

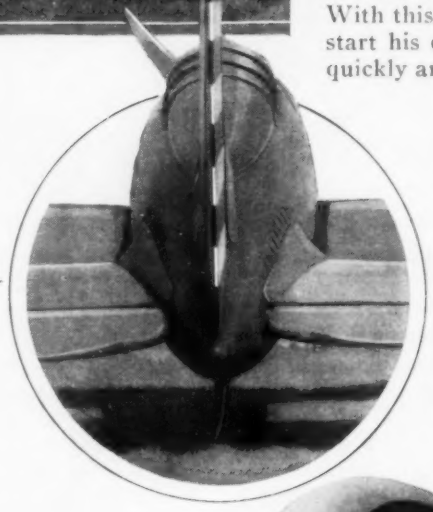
ment missions, the pilots need to know more about weather. When Captain Eaker took off recently from California on his flight toward the Atlantic, he was told by the weather bureau at what altitude to fly throughout the length of his journey. From Los Angeles through Phoenix, Albuquerque, Wichita, St. Louis, Wright Field and Uniontown, Pa., to New York the wind directions and velocities at all altitudes up to 10,000 feet were charted. He had only to start eastward and fly at the levels prescribed by the weather bureau.

Captain Eaker's plane, which was rebuilt in a California factory for the army in five days, represents the greatest perfection yet attained in streamlining an airplane to smooth out the air rushing along the sides of the fuselage. From a tiny spinner, covering the hub of the propeller, to the tail, surfaces have been smoothed out to cut down resistance and friction. The cylinders of the engine are covered at the ends by a ring, modified from a cowling worked out during recent years by the National Advisory Committee on aeronautics. This adds about twenty miles an hour to the plane's speed.

The large air wheels on which the fast plane lands are wound up by the pilot after he takes off. They fit into the lower side of the wing, and metal shields, fitting on the axles, become part of the lifting surface of the wing when the wheels are up in flying position. The wheels may be wound up or dropped down for landing in fifteen seconds. With this plane, the army can transport seven men from coast to coast, with one stop for food and fuel, in about twelve hours. The engine with that load would consume thirty gallons of gasoline an hour while turning 1,900 revolutions a minute. Flying somewhat slowly, about 175 miles an hour, this low-wing combination transport and bomber can fly safely from Los Angeles to New York or from New York to Paris and yet have enough gasoline for safe reserve. At this rate it would cross the Atlantic in about half the time required by Col. Charles A. Lindbergh in his epochal flight.

The retractable gear on this plane is the first adopted by the air corps for practical flying. Hiding the wheels in the wing and using a supercharged engine that pours 540 horsepower out through the



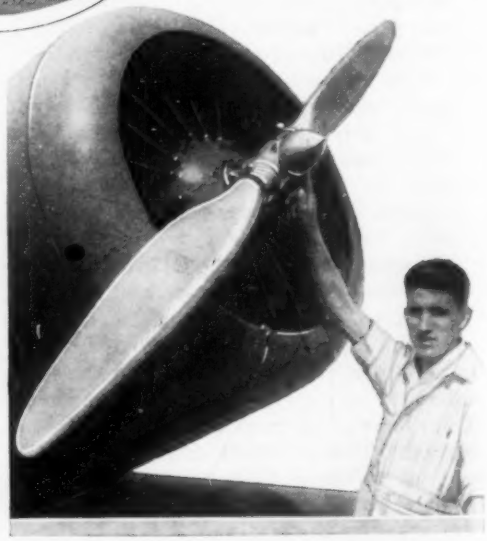


propeller gives the plane a top speed of 220 miles an hour. Many of the army's newer planes not only have fuselages built of metal, but the wings themselves are constructed of metal spars and braces, with thin metal coverings.

"We have been trending toward planes built of strong, light duralumin, an alloy," explained Lieut. B. M. Giles, one of the air corps' veteran engineering officers. "Dural, as flyers call it, may be more difficult to maintain, but it has thin walls and is very tough and strong. Some of the newer experimental planes are built wholly of metal. Even the wooden and composition propellers have given way to dural drop-forged props. These give longer service and require no particular care in their use. When we want to inspect a metal prop, we can etch it quickly in caustic soda and nitric acid and inspect its surface under a microscope for flaws.

"Fabric wing coverings can be replaced each year more cheaply than metal-covered wings can be built. But the metal cover has advantages, particularly in war time. It will not tear easily or burn. Some of the experimental attack and observation planes are metal-covered, except the wings, where fabric is used. Several observation and transport ships have been constructed throughout of metal, including the wing coverings. The smooth metal is riveted onto internal spars and braces. These coverings, on both fuselage and wing, are expected to last as long as the plane. The metal skin gives the plane greater strength and does not require annual replacement.

"One of the more important recent developments is the electric inertia starter for engines. With this, a pilot flying alone can start his engine from the cockpit quickly and take off in a few seconds. This device consists of a flywheel that makes 12,000 revolutions a minute. When it engages the crankshaft, it turns the engine over very fast two or three times. If the engine should backfire, a metal clutch slips backward and absorbs the energy developed in the kickback. With this appa-



Tail and Front Views of 200-Mile-an-Hour Transport Plane, Which Carries Bombs or Passengers

One of the Newest Army Planes; an All-Metal Monoplane with a Speed of 221 Miles an Hour; Note Its Fleet Lines and the Streamlining of the Body and Landing Gear

ratus a whole squadron of pursuit pilots, in hiding on some deserted field, could start their engines and be in the air in one or two minutes."

There are several interesting new developments in military airplanes. All-metal construction offers possibilities of better streamlining, with consequent faster speeds. The army now is experimenting with all-metal monoplanes for attack, bombardment, pursuit and observation purposes. On one of the great bombardment monoplanes the wing is three feet thick.

New attack planes, capable of dropping ten bombs each on a target during a single dive and raining the ground with machine-gun bullets as they pull away, have appeared. This is distinctly an American development. Attack aviation really did not exist during the war, except to play a very minor experimental part during the last few weeks of hostilities. Now an all-metal attack plane, fifty miles an hour faster than anything the army had a year ago, has been developed.

New tactics with swifter ships are being developed by the attack squadrons at Fort Crockett, an old artillery post abutting the Galveston sea wall on the Gulf of Mexico. With new, fast planes, the attack pilots "strafe" moving targets and wreak considerable havoc. On this problem, which represents the harassing of troops behind the lines, they first took a column of troops and a truck train on the road and, at the first sound of approaching planes, the soldiers scattered and stopped in their tracks when the planes came over. From this, the situation was plotted, showing the men at the first and their new positions, the entire area covering the length of the train and a width of 150 yards. Then a target duplicating a similar wartime target was constructed.

Cardboard soldiers dot the ground and the attack planes approach singly, in echelon and in three-ship formation, firing through forward machine guns as they drop down, releasing fragmentation bombs as they pass over, and again spraying bullets over the area from a gun in the rear cockpit as they pull away. Each attack plane carries four forward and one rear machine guns and ten twenty-five pound bombs.

One interesting although dangerous experiment has brought about development of a new-type bomb with a fuse delaying the explosion from seven to ten seconds after it leaves the plane. Although the plane may be flying at an altitude of 300 feet and at a speed of 175 miles per hour over a target, occasionally the exploding bomb sends one or more of its fragments into the plane that dropped it. One pilot had his ear cut by a fragment of his own bomb. Since the bombs are effective within a 200-yard radius and burst on impact, they always are a source of danger to low-flying planes. Frequently the pilots make of themselves a "sucker shot," as the attack pilots phrase it, for anti-aircraft batteries. Now, in one maneuver, they fly close to the earth and pass the anti-aircraft much as a bird will wing past a window. In this way they are only a transient target and their safety lies in low, fast flying and taking concealment in the terrain itself.

Partly Completed Statue of Christ on a Mountain in Brazil; It Is 150 Feet Tall and the Spread of the Arms Is 125 Feet

CHRISTUS STATUE ON MOUNTAIN TO BE SEEN FOR MILES

Within a few months, Brazil will formally dedicate its Christ of Corcovado monument, the world's largest Christus statue. It stands 150 feet tall atop Corcovado mountain, 2,200 feet above sea level. The statue, started in 1927, will cost $720,000. The outstretched arms have a spread of 125 feet, and it is built of reinforced concrete and surfaced with blue-green tile. It can be seen for many miles at sea and already serves as a conspicuous landmark.

¶Electric stoves that operate an hour and a half when a dime is inserted in a slot have been installed in the winter camp ground of Yosemite national park.

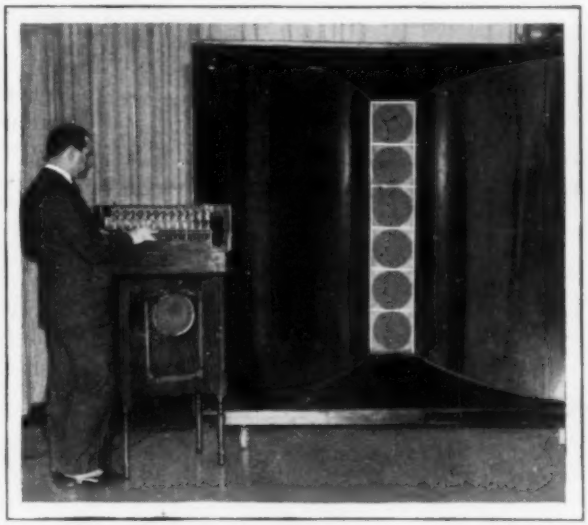
NAMES OF FAMOUS BRING HIGH PRICES

Signatures of celebrities, both living and dead, are worth sums ranging all the way from five dollars to many hundreds, as attested by the catalogs of autograph collectors and dealers. The autographs and handwriting of famous persons long since dead are sought by dealers in musty records, often found stored away in attics or among other papers that have lain forgotten for many years. Often the signature of some famous person remains in one family for a long period, being passed from one generation to another until the letter to which it is attached finally is obtained by a dealer and sold into the hands of some collector. Many collections of names are valued at thousands of dollars, and both collectors and dealers go to great pains to determine the authenticity of a signature. There are bargains in autographs just as there are in other commodities, and one catalog lists for a few dollars original signatures of celebrities ranging all the way from former presidents to Jenny Lind and Queen Victoria. The value of an autograph depends not only on the degree of fame attained by the signatory, but also on the rareness of such signatures and the type of document or letter to which it is attached. Signatures of former President Roosevelt, for instance, are listed by one dealer all the way from five to seventy-five dollars. A historical letter by John Adams is quoted at $275, and a receipt issued by Benjamin Franklin, "for fourteen hundred German spelling books," is considered worth $450, while a letter from Abraham Lincoln to General Burnside is quoted at $375.

WEAKNESS IN AIRPLANE WINGS FORETOLD BY ROBOT

One more mechanical aid to safe flying has been brought forward in the form of a robot which keeps the pilot informed about the condition of his wings during a flight, thus averting the probability of a structural failure in mid-air. The attachments, little larger than thimbles, are fastened to each wing tip and a similar instrument and grid-glow tube is in the cockpit. A red light warns the pilot of a weakening wing. The structure of wings hidden under fabric or metal may deteriorate from wear, crystallization of metal or other causes without the pilot's knowledge. The robots make use of the inertia of tiny weights. They ride in pairs in vertical holes in a block of aluminum about the size of a cake of soap, and are held in place by springs. Previously the appliances had been used in somewhat similar form to indicate wing shock, but by placing a robot also in the cockpit, they can be adjusted so that, when the difference between the shock on the wing tip and that on the cockpit goes beyond a certain limit, the grid-glow tube will light, thus warning the pilot to land. Later such robots may be placed at points along a wing and also on the tail surfaces.

Attachment for Plane Wing Which Warns Pilot of Danger of Structural Failure in Flight



Electric Carillon Which Can Amplify Sounds of Tiny Chimes to Represent the Music of the Largest Bells

MUSIC OF BELLS IS PRODUCED BY ELECTRIC CARILLON

Tones louder than can be made by the largest bells, or notes as soft as the tinkling of the chimes in a boudoir clock, can be produced on an electric carillon which, through electrical vibrations, produces bell music in a much wider range than is possible with real bells. The carillon consists of a series of small chimes which are struck by tiny electric hammers actuated by a keyboard. The notes thus made are barely audible, but the vibrations of the steel chimes create small electric currents in devices somewhat like the pick-up on an electric phonograph. These currents are amplified by vacuum tubes and played to an audience through a loud speaker.

CAVALRY DIRECTED BY RADIO

Radio is being used in tests to guide the maneuvers of cavalry, the mounted troops receiving their orders in the saddle and carrying out the wireless commands. It is expected radio control of the riders will add to the efficiency of cavalry troops since they can operate more effectively with the armored trucks and motor cars that have used radio for some time.

¶With a population of 3,156,141, Shanghai is the largest city of the Far East.

Driving Glasses for the Motorist Equipped with Mirrors at Sides to Provide Rear Vision

MIRRORS FOR DRIVING GLASSES PROVIDE REAR VISION

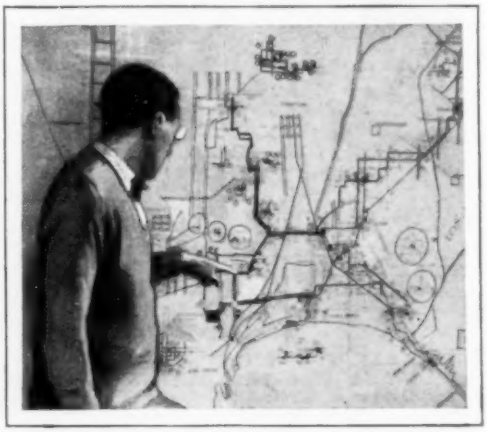
Driving glasses for the motorist now offer rear vision as well as an improved front view. The glasses are fitted with small mirrors at each side of the frame, enabling the driver to see what is behind by a glance into one or the other of the mirrors without turning his head.

AIR'S CARBONIC ACID CONTROLS TEMPERATURE OF EARTH

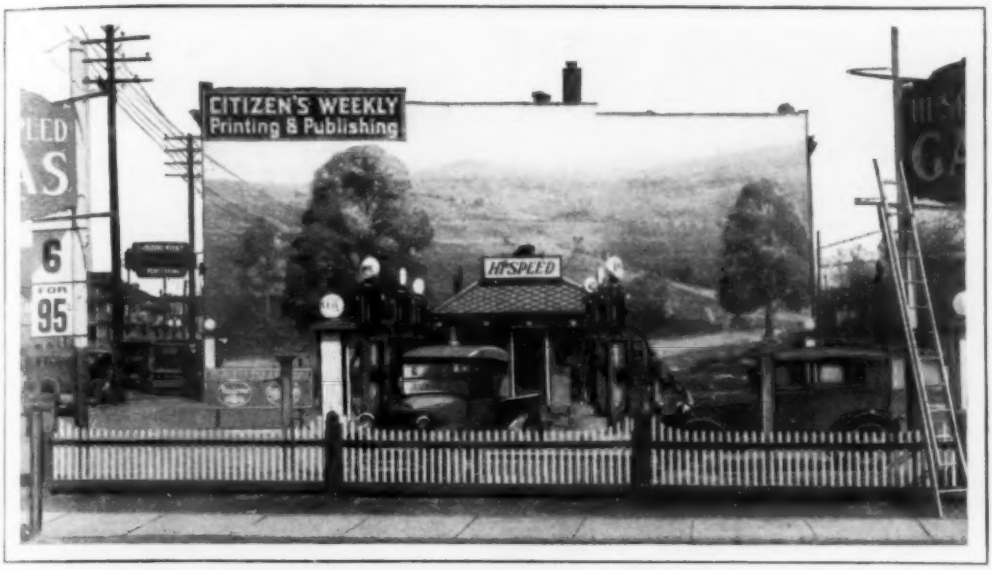
If the amount of carbonic acid in the air decreased to half its present volume, the temperature would fall enough to cause another great ice age on the earth. Calculations showing this were disclosed recently by Dr. E. O. Hulburt of the U. S. Naval Research laboratory. The small amount of carbon dioxide in the air absorbs much of the heat of the sunlight falling on the earth's surface. A change in the amount of this gas alters markedly the amount of heat retained by the air, and therefore the average temperature over the earth's surface. Doctor Hulburt's work was concerned with calculating the air temperature to be expected from a knowledge of the kinds and amounts of different gases present in the atmosphere at different heights and from a knowledge of how the various constituents of sunlight are absorbed by these substances. The sea-level temperature calculated from his formula comes within one degree of the known average earth temperature. This is taken to mean that emission and absorption of radiation are the only processes concerned in the control of the earth's heat on the surface.

CRUDE OIL FLOW REGULATED BY PIPE-LINE DISPATCHER

One oil company employs a pipe-line dispatcher whose duties are similar to those of a train dispatcher, since he controls the distribution of the oil flow throughout the entire pipe-line system. The dispatcher must see that the amount of oil delivered from the field or elsewhere checks with that received at the terminal, and determine the cause for any discrepancy. In the handling of different commodities through the lines, he also must exercise care to prevent contamination of one product by another. A large map of the pipe-line system shows the actual operation of the lines, pegs being used to indicate when gate valves are open or closed, so the dispatcher knows whether oil is flowing and where it is bound.



Map Used by a Pipe-Line Dispatcher Showing the System of Lines and Position of Gate Valves



Scenic Background Painted on Wall of a Building at the Rear of a Filling Station, to Provide a Pleasing Effect and Attract the Attention of Motorists

GAS STATION MADE ATTRACTIVE BY PAINTED BACKGROUND

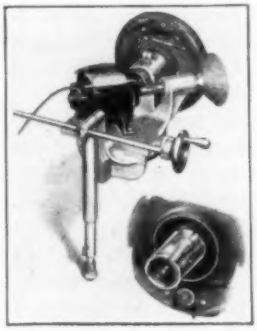
To provide an attractive setting for a filling station in a Michigan town, the owners hired a scenic artist to make a rural scene in full color on the brick wall of a building at the rear of the station. The large scene, which covers the entire wall of the building, provides a decorative background for the station and also draws the attention of passing motorists.

GAUGE LIKE A TRAFFIC SIGNAL SHOWS SIZE BY LIGHTS

Like a miniature traffic signal, an electric gauge, in the inspection department of an automobile plant, flashes green, amber and red lights to indicate to the operator whether the part being checked is undersize, correct or oversize. It shows with certainty a variation as small as one hundred-thousandth of an inch below or above the size specified on the production blueprints. For each part to be inspected, two standards are made of hardened alloy steel and lapped to exact size, one to the high and the other to the low limit. These standards are used by the operator for setting the gauge for any new part to be inspected and for checking it from time to time. The gauge increases the speed of inspecting and removes eyestrain, since the operator needs only watch the lights after it has been set correctly.

BRAKE-LINING GRINDER FOR CAR GIVES EVEN SURFACE

Attaching to the axle or housing of an automobile, a brake-lining grinder acts also as a micrometer gauge, thus eliminating the use of expensive measuring instruments in adjusting brakes. The grinding disk first is adjusted to the exact size of the brake drum and then revolved to a point opposite each eccentric. The shoe is fitted so the lining just touches the grinding disk, and is anchored in position, after which the motor is started and the grinder is revolved one or more revolutions, taking off all high spots and making the lining conform to the curvature of the drum. This insures the entire area of the shoe connecting with the drum. A micrometer adjustment permits any desired clearance between lining and drum.



The Flying

Above, Transmitting Air Weather Report on Teletype; Below, Plotting Course of Pilot Balloon from Readings of Theodolite Received by Phone

"HOW'S the weather today, chief," came a voice over the phone.

"Everything grounded till noon," was the reply. "Call me then."

"But the president wants a ship for a special party," insisted the voice on the wire.

"Can't do a thing till after twelve o'clock," came the answer from Ward T. Van Orman, meteorologist of the Goodyear Tire company, one of the growing army of forecasters which is playing a more important part in modern industry every year.

Never before has the weather received such world-wide attention. Four great nations—Great Britain, France, Germany and the United States—gather and exchange data on the North Atlantic. Expeditions are studying "Greenland's icy mountains," and its icebergs and winds, to better forecast storms and devise a northern flying route. Weather stations on the antarctic continent are predicted for the same purpose.

All over the globe thousands of kites, balloons and airplanes go aloft daily to read temperature, pressure, wind direction and velocity. Automatic typewriters send hourly reports along 6,000 miles of airways. Static is being harnessed to forecast storms. In two and one-half years the number of special meteorological stations along airways has increased ten times over. Five years ago the weather bureau spent $75,000 a year on civil airways, while today it spends over $1,300,000.

The young man taking up meteorology as a career today is advised to enroll for a four-year university course. Field service follows. "Before the college man can take charge of weather service at a large airport," says Willis F. Gregg, of the weather bureau, "he will need three to four years of field experience. An airport station giving twenty-four hour service requires four to six men, especially where there is much night flying.

Weather Man

Right, Chart of Aerograph with Curves Showing Moisture, Temperature and Pressure; Below, Weather Observer Holding Self-Registering Instruments

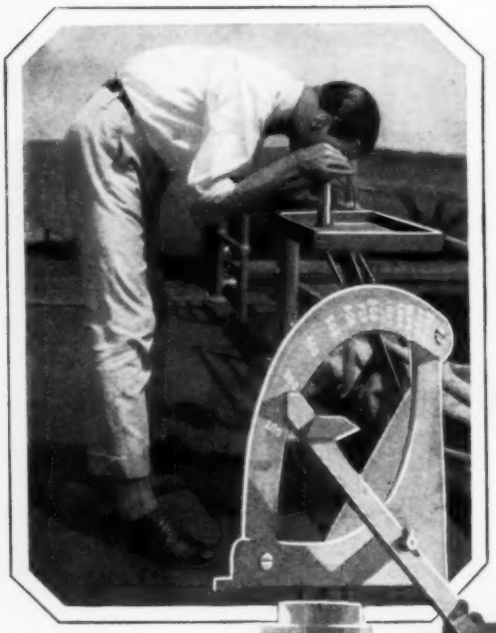
"There are now over thirty airports where regular observations are taken, covering such flying conditions as ceiling or height of low clouds; visibility; wind direction and velocity; temperature and pressure; upper wind data, and general conditions. Such data enable the pilots to avoid fog and low clouds, heavy rain, sleet or snow, severe thunderstorms and dangerously low visibility. No air-mail pilot flies today until he has the latest report, sometimes from an incoming pilot as well. The great reduction in accidents last year is the result."

More than 100 junior observers are appointed in the weather service annually, after taking civil-service examinations. For this work high-school training or equivalent is required, including one year of physics. The entrance salary is $1,440. Senior meteorologists receive $2,000, and the highest ratings are $5,600 and $6,400 a year.

"Large industries," said James H. Scarr, of the New York weather bureau, "will soon employ their own meteorologists, to interpret the data gathered by the weather bureau. Shipments of live stock, chicks and perishables of all kinds, depend upon accurate weather knowledge."

Along the Pacific coast experts already are employed to forecast, a year or more in advance, rainfall and storage-basin conditions for power plants. The Southern California Edison company forecasts its water receipts, as deficits must be made up from steam plants. Fruit growers must know what to expect. "Large industrial organizations," says Prof. George F. McEwen, of the University of California, "are maintaining research departments for the purpose of improving forecasts essential to efficient management."

Professor McEwen is studying the Japan current and mid-ocean temperatures to develop a method of forecasting weather far in advance. In the next quarter-century it is probable that meteorologists will have determined all the basic



Courtesy Carnegie Institution

causes of our changing weather. From mid-ocean, island, polar and moving stations of all kinds they will know long in advance just what weather to expect.

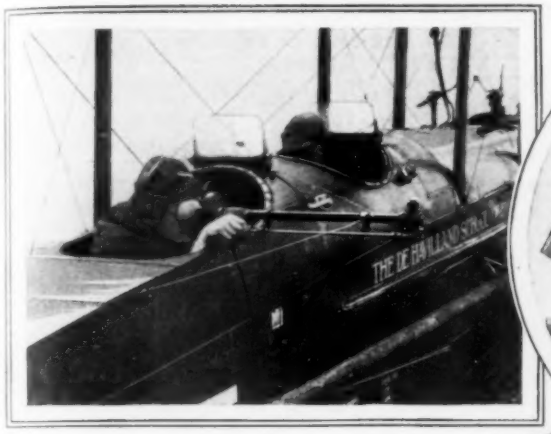
Meanwhile, the weather scientists are rapidly devising the best instruments for recording changes. A fully equipped office will have barometers and at least one barograph, to record the changing atmospheric pressure on a moving drum; thermometers for maximum and minimum readings, and thermograph for recording them; a psychrometer, which by reference to tables gives relative humidity, or moisture, in the air, dew point and vapor pressure; hygrometer and hygrograph, for humidity; anemometer, to give velocity of wind, and anemoscope, or wind vane, for direction of wind.

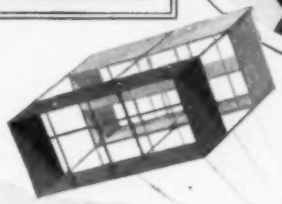
Radio has added vast opportunities to the weather service. In Germany and England weather maps are sent by radio to aircraft; last year the dirigible "R-100" sent reports and maps to its sister ship the "R-101," while aloft. On western airways here pilots converse fifty to 100 miles away, and warn each other of bad weather ahead. An airway observer is stationed at all emergency landing fields along our chief airways.

Early each morning from the surface of three oceans and from the several naval air stations scattered around the rim of the United States, the navy's flying weather men take off for a two-mile high jaunt into the heavens. On the lower right wing of each plane, swinging in rubber cords, is an automatic weather instrument on the cylinder of which is written a story of the upper air by which all of Uncle Sam's naval airplanes are guided in their dangerous missions over the sea.

Each fleet has its aerial weather observer. From the Atlantic, the waters of the Pacific and along the shores of China, the flying weather men observe weather in the making while riding aloft. At each air station, from Anacostia to Sand Point, Washington, weather experts climb into the blue each day. And from their

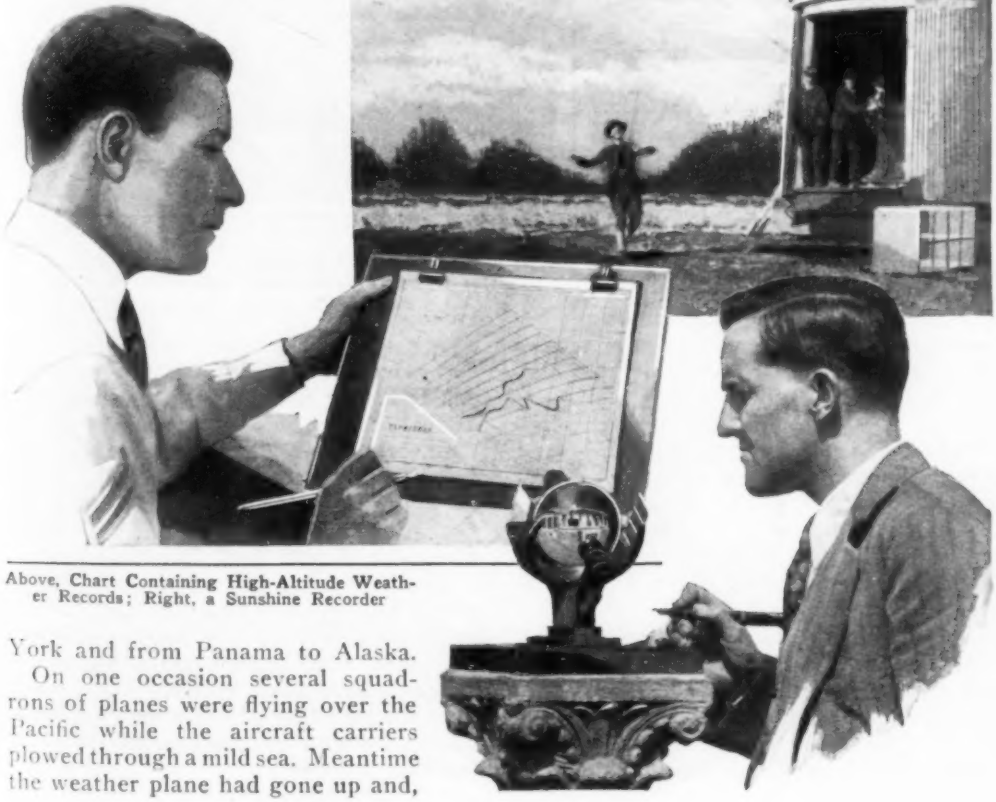
Top, Making Dust Count; Center, Measuring Ceiling Height; Below, Determining Force of the Wind





Upper Left, Measuring Earth's Reflecting Power from Plane; Above, Using Clinometer to Tell Cloud Heights at Night; Below, Sending Up a Kite at a Weather Station

composite observations and the recordings of their delicate instruments, the navy's own weather service charts the air each thousand feet from the ground up to an altitude of two miles, and predicts with accuracy the weather from China to New



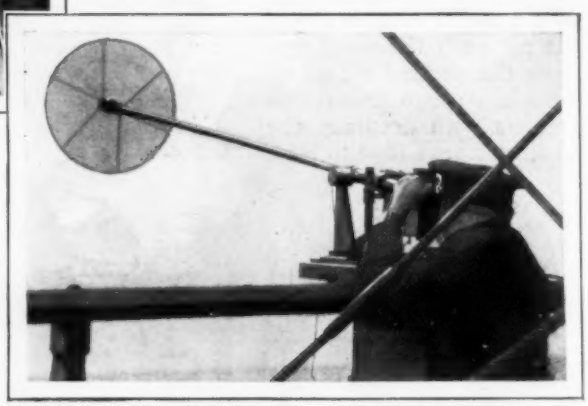
Above, Chart Containing High-Altitude Weather Records; Right, a Sunshine Recorder

York and from Panama to Alaska.

On one occasion several squadrons of planes were flying over the Pacific while the aircraft carriers plowed through a mild sea. Meantime the weather plane had gone up and,

in the west there is a temperature inversion, fog will come rolling in from the Pacific by nightfall.

While the navy's efforts to chart the upper air and to make weather forecasts are the most important meteorological undertaking now in progress, they still know little about the upper atmosphere. And so important are these observations considered that plans now are under way for a flying weather man to accompany the army's air forces during all future maneuvers. It will be his task to issue every hour observations that will tell the pursuit planes, the bombers and the observation ships where they will find clouds and clear spots during the next hour of flying. In code these directions will fly through the air and enable the large at-



Courtesy Carnegie Institution

Above, Observing Flight of Pilot Balloon with Theodolite; Below, One Way of Measuring Atmospheric Electricity

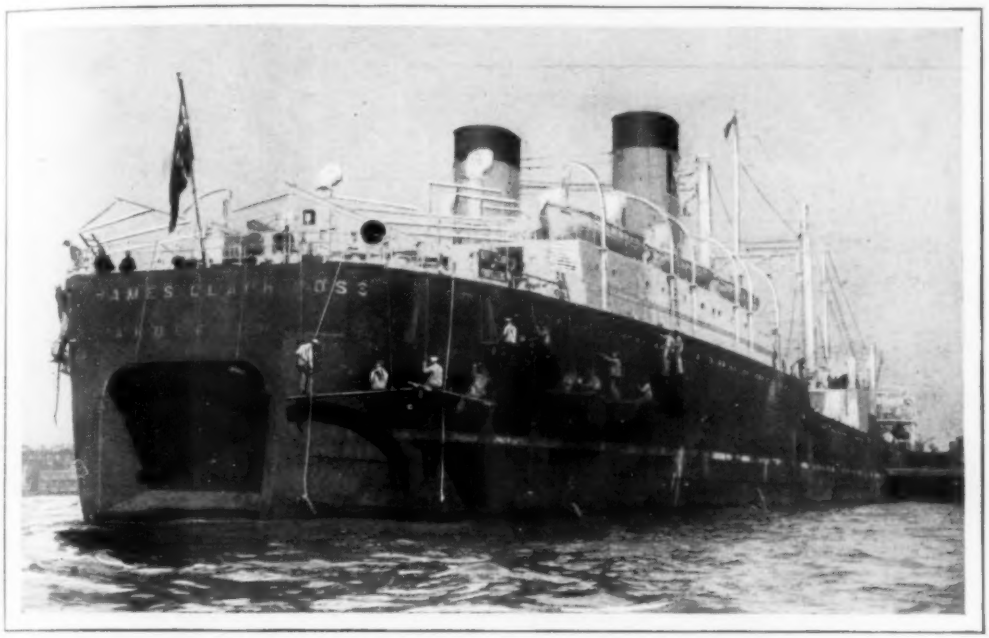
after the charts had been studied, the weather man reported a storm would descend in two hours. The radio crackled. Although the sun was shining and fair weather seemed indicated on the surface, all planes were called in. And exactly two hours after the first warning, rain was falling in torrents. At another time the fleet, warned by an aerial weather man, put into a harbor until a hard blow had passed.

Upper-air soundings are important because changes in the wind that affect the weather take place at considerable altitudes, from 4,500 to 6,500 feet above the earth. At those altitudes wind currents are less affected by ground friction and changes in topography than lower currents. In fact, at one point the wind may be blowing due east a mile above the ground while surface conditions may have it warped far out of its true course lower down.

Navy high-altitude observers have learned that, if the temperature falls rapidly as the plane ascends, rain will come. If the atmosphere changes rapidly at different levels—is in a state of turbulence—nearly anything may happen. If tacking force to surprise the "enemy." That's one of the important aims of the flying weather service for the navy, to enable its air squadrons to proceed with utmost secrecy on any important mission. Capt. Ira Eaker, on his recent 200-mile-an-hour flight from Long Beach, Calif., toward the Atlantic, depended on such information and, as a result, knew just where he would find favorable winds.

Weather men want to learn more about what's taking place two miles above the earth because they are becoming more convinced that storms start up there. Balloons have been sent up twenty-two miles for soundings, but no man has been able to fly with his instruments to even half that altitude.

GIANT WHALING SHIP BRINGS FORTUNE IN OIL



View of Giant Whaling Ship, "Sir James Clark Ross," Which Bagged 1,444 Whales during an Eight Months' Cruise; the Value of the Oil from This Catch Is Estimated at $1,250,000

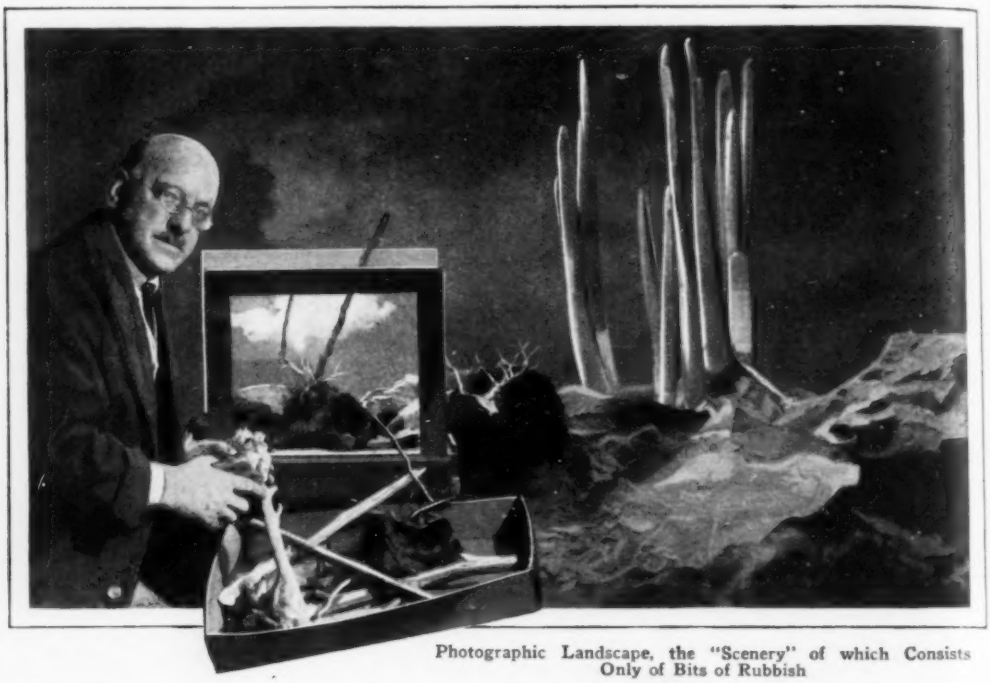
After an eight months' cruise, the "Sir James Clark Ross," giant among whaling vessels, reached New York recently at the end of its maiden voyage with a million-dollar catch. The great two-funneled craft left Norway last August and in eight months bagged 1,444 whales, the catch yielding oil with an estimated value of $1,250,000. The boat traveled 25,000 miles in its quest for whales, and one man among the crew killed 254 of the creatures.

STREAMLINE DESIGN IN NATURE SHOWN BY HEADS OF FISH

Fish were the original streamline designers, and their heads form the keynote elements in their designs. Man has learned with much labor and blundering to follow the principles the fish seem to have adopted from necessity. Dr. William King Gregory of the American Museum of Natural History, who has made a study of the skulls of 200 types of fish, says these structures offer solutions of problems in both engineering and physics. The normal fish skull is more or less bluntly wedge-shaped, both in top and side views. This is a necessity imposed by the streamlining of the fish's body, for in a properly streamlined design the greatest diameter is well forward of the middle. The fish's head, therefore, widens rapidly to fit this widening of the body. Furthermore, if a fish is flat from top to bottom, its skull is flattened in the same direction, while if it is flat from side to side, the skull is high and narrow. The fish's head, of course, is not a mere wedge stuck in front of the body, for it must also carry important organs of sense, and so there must be a compromise with the result that the head is not perfectly streamlined, but is as near perfect as natural conditions permit. As an entering wedge in the fish's progress through the water, the skull must take the thrust of the water from the front, and the push of the backbone from the rear. This play of opposing forces has brought about systems of bracing and strengthening of bony structures ingenious in detail and harmonious as a whole.

¶A process for making industrial alcohol from natural-gas waste has been developed in Canada.

PHOTOGRAPHIC LANDSCAPES FROM RUBBISH HEAP



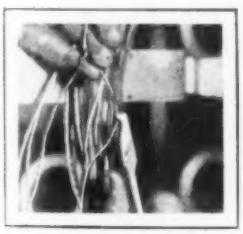
Photographic Landscape, the "Scenery" of which Consists Only of Bits of Rubbish

Sticks, stones, twigs, roots, dried grasses and old fur, jumbled together in a box, would under ordinary circumstances be called rubbish. But to a Toronto photographer these things are the materials from which he makes landscapes to photograph. And the success he has had with his synthetic landscapes is world-wide. A. T. Roberts is a commercial photographer in the daytime, and his business also is his hobby. In a corner of his basement, he keeps an old plate camera, a table, shelf, and a few multiple electric-light sockets. Here he plays in the evenings, building up, from the odds and ends that most people discard, realistic landscapes. Whenever Mr. Roberts has an idea for a landscape, he makes a small sketch of it. Then he rummages through the assortment of boxes for just the right twigs and sticks to make his trees. A root turned upside down becomes a fine tree, and grasses bundled together make excellent poplars. Trying out various twigs, sticks and grasses in this way, he locates the right ones for the particular scene. These he pastes onto his workboard, about two feet square. That is the first step. Then comes the sky. A box full of assorted skies is on the shelf. These are actual skies which he has photographed. The right sky is picked for the picture, the wind direction as shown in the clouds is noted, and the trees built up accordingly. They must stand in the ground, however. Sand, either dry or wet, here comes into play. It is spread on heavily or thinly, depending on the effect desired. Paths are made by making a thin groove with finger or pencil. Perspective must not be lost, and the path must lead somewhere in the distance. Wagon wheels depicting a road are sometimes used. Effects by means of paths or roads can be made so that the distant skyline will seem twenty miles away. Grassy hillsides are made from old fur trimmings of coats. Placed over small stones, sand-strewn in places and rubbed the way the wind is blowing, they form the grassy slopes. Wet cotton batting rubbed black, coal, clinkers out of his furnace, grit, sponges, and many other items of similar nature go to form the contours of the landscape. Once the scene is built up, a frame is put in front of it. Through this the last touches

are put on, as looking straight through it the effect gained by the camera is produced. While lighting the scene is the most important part of the procedure, no extra-powerful lights are used, only those to be found in every home, varying from forty to 100 watts. A very small arc light is occasionally used. With the lighting arranged overhead or from the side, and sometimes even from underneath, there is another readjustment of the odds and ends that make up the landscape. The manner in which the clouds are lit on the photographed sky, solves the direction from which the greatest amount of artificial light must be directed.

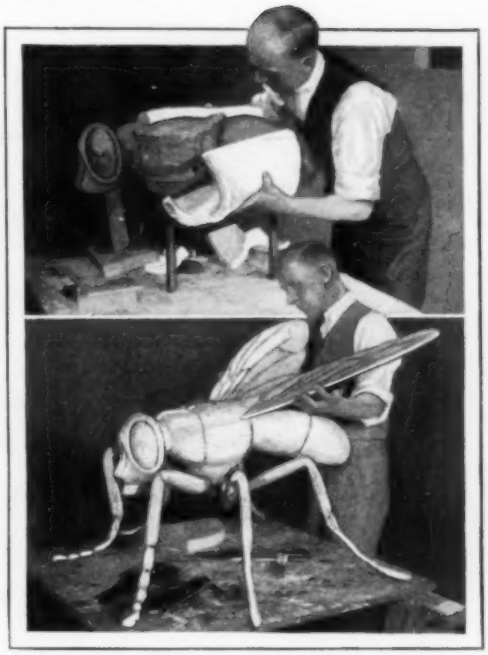
ELECTRICIANS AIDED BY PLIER IN REMOVING INSULATION

Electricians often experience difficulty in removing insulation from wires with ordinary pliers because the insulation must be mashed near the jaws, and the wire is thus flattened so it may easily break. To overcome this difficulty, a special plier has been made. The tool is ground down near the point so the wire enters at the most convenient angle, and only a small surface of the insulation is exposed to the pressure of the jaws, thus enabling the workman to cut it without injury to the wire itself. By locating the cutting point near the tip, small pieces of insulation will fall instead of clinging to the pliers as is the case when the covering is mashed near the jaws.



GIANT HOUSEFLY RUN BY MOTOR SHOWS DANGERS OF PEST

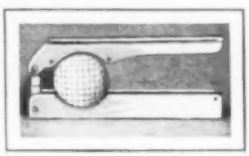
Visitors to state fairs this year will see a motorized housefly bigger than a bulldog whose terrifying appearance is enhanced by electric illumination. The giant mechanical fly was constructed by the government to demonstrate how the pest spreads disease and contaminates food. It is made of papier-mache and plaster, and inside the body is a tiny motor and reducing gear which enables the insect to raise and lower its head, thrusting it into a sugary solution and lifting it out. Building the gargantuan insect was no simple matter. First, a model of the fly's body was made of wood and wire and a casting was formed of that model. The papier-mache shell was built over this core. The insect is two feet high and thirty inches long, has lifelike wings and papier-mache legs reinforced with wire.



Making Model of Giant Housefly; Electric Motor Inside Body Raises and Lowers the Head

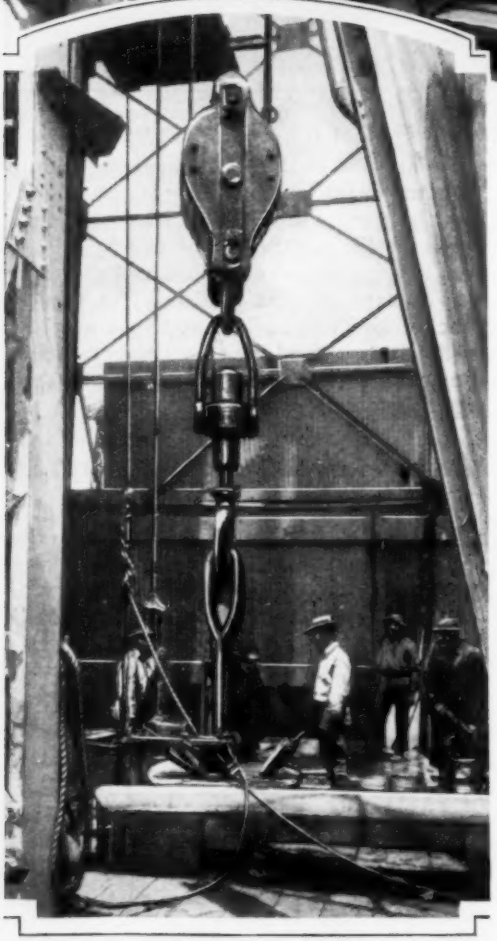
NAME PRINTED ON GOLF BALLS BY SELF-INKING MARKER

Golf balls can now be printed with the full name of the owner by a self-inking marker which presses in the means of identification without injuring the balls in any way. The device, when in operation, somewhat resembles a nutcracker, the ball being placed in a grooved receptacle in the end, and pressure being applied to two handles. The ink tube or cartridge always is in position for inking the type and consists of a flexible tube of indelible ink, which is supplied to a silk pad through fine perforations.



Two Miles Down

Drillers around the "Kelly" Which Fits into Square Hole on Rotary Table



Traveling Block, Swivel and Hook Ready to Pick Up String of Drill Pipe

EVER since old Colonel Drake in 1859 drilled what later proved to be the first oil well—down to a depth of sixty-two feet—man has dropped his drilling tools deeper—seeking larger oil production and longer-lasting fields. Ten years ago, a 5,000-foot well was considered very deep, but today that depth has been virtually doubled. A rotary drill has gnawed its way 9,700 feet below Semi-Tropic ridge, on the west side of California's San Joaquin valley.

One hundred and nine tons of thin-walled steel pipe, with a hard bit screwed onto its lowest stand, drilled the last foot of this deep hole. Down through a two-mile column of mud, through alternating layers of sand and shale, toward the bottom of what in the Pliocene period was an ancient sea, the hole points.

As the bit turned 100 times each minute, up through the hole, outside the drill pipe, came quantities of dark-gray mud. It had traveled from the surface two miles down and up again. As it poured down the sluice boxes, darker streaks and bubbles of varying dimensions marked its surface. Oil! Black gold had come up two miles to the light of day.

Here, on a gamble, man had sent down

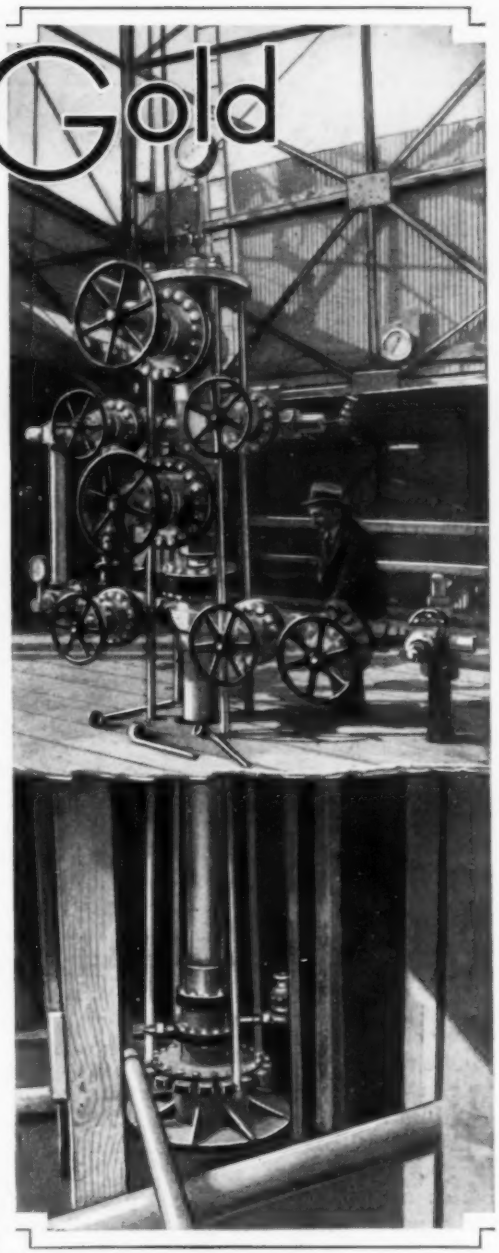
for Black Gold

his tools seeking the deepest oil sand yet penetrated. Geologists had learned that another near-by well had shown traces of oil. So Shell Oil company officials decided to spend $300,000 in testing a new area. Down went the bit for the first time in June last year, and until late February, three drilling crews worked daily, running in, drilling, running out, until the world's deepest oil well had been completed.

During the last mile and a half of drilling, the crews took samples of the earth for study. Alternately the bit passed through layers of shale and sand, both fairly hard, gray deposits. Once the drill bored through a 100-foot layer of shale, one of the widest found during the two-mile descent. When the "cores," as oil men know them, were examined under the microscope there appeared millions of minute shellfish, or "forams," (foraminifera) which existed in the ancient sea that once ebbed and flowed in what is now California. Their bodies gave up much of the oil that flows from California holes.

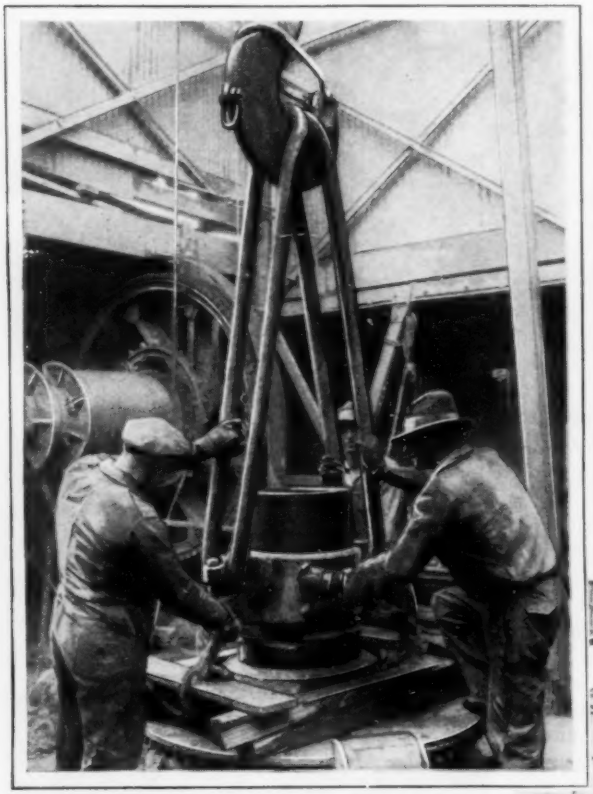
Eventually the drill in Williams No. 1 will have reached the bottom of that ancient sea. Until that time, the oil possibilities of the hole will not be exhausted. Whether this thin-walled steel drill pipe can sustain its own great weight at depths of three or four miles remains to be learned. Aside from overcoming that great weight and battling the intense heat that exists at such depths, drill crews are ready to explore further down for oil.

In drilling down to 9,700 feet, one sees the modern application of science in drilling an oil well thought impossible five years ago. No one was injured, no tools were lost, there were no long-drawn-out breakdowns. Steam turned the drill, and down it went. As it descended, mud returning from the depths increased in heat until at last the circulating fluid when it escaped into the sluice box reached a temperature of 126 degrees Fahrenheit.



"Christmas Tree" Placed over Mouth of Well to Be Brought In; by Means of the Various Valves Pressure Can Be Controlled

Each day the job became more difficult, until at last each morning the crew would run in 121 stands of drill pipe, each eighty feet long. Four hours of each twenty-four, the derrick man would swing the great traveling block in to pick up a stand.



Lowering String of Large Casing in Well; Right, Silent Electric Motor and Gears Inclosed in Single Box for Pumping a Deep Well

the driller would manipulate the engines and the cathead, lead tongs and back-up men would spin in stand after stand, lock them and pull the slips to permit the powerful engines to drop the string down another eighty feet.

The pressure of the column of mud enables the operator to keep the hole open even now during the lower 1,200 feet; that is, there is no casing below the 8,575-foot level. Although the column of mud builds up a pressure of 5,000 pounds to the square inch, and thus fights back the walls of mother earth, the drill pipe forces its way down and, like a snake, follows any curvatures that may exist in the hole, until it reaches the bottom. Sometimes these deep wells will wander 2,500 feet away from their vertical path during a descent of 7,500 feet, yet the drill pipe does not break, so great is its strength and flexibility.

But how deep can man drill for oil? The limit seems to be governed by heat and weight. When Williams No. 1 reached 9,700 feet, 218,250 pounds of pipe and drill hung from the cable running down from the top of the 122-foot tower. The drillers have learned a trick, though, that helps relieve this great weight materially. A float valve, which allows the mud to flow down but never up through the drill pipe, helps make the pipe float as it rests on the column of mud. Even then nearly nine-tenths hangs from the top.

At a depth of two miles, the wells are so hot and the pressure is so great that work proceeds only with difficulty. Water alone has a pressure of 4,330 pounds to the square inch, and a column of mud standing that deep in the hole has an even greater pressure. It is this pressure holding back the earth that enables drillers to go down in an "open hole" at that depth without dropping a string of casing.

But the heat! At 7,000 feet in one well a thermometer registered 206 degrees Fahrenheit. Before cementing that well, fifty tons of ice were circulated to cool the formation. And when you think that one hole was recemented nine times, and still was wet, you can picture some of the difficulties of drilling two miles below the earth's surface. Often 1,000 or more sacks of cement are used to shut out the water, and when this fails, the drillers do not know whether they have made a mistake in their method, or the great pressure has squeezed all the water from the cement before it has time to reach the proper place and harden.

In sinking deep wells, the drillers defer inserting casing as long as possible for with each string set the diameter of the hole is reduced. On Williams No. 1 the top of the hole measured twenty-seven inches in diameter, but this was reduced progressively until it was only eight and one-half inches across at the bottom.

No hole deeper than 9,000 feet has yet produced oil. At least four others have gone below that great depth only to yield water—and disappointment. Yet the eternal quest for deeper oil fields goes on, and oil men believe the time will come when they will draw this liquid gold from wide belts three or four miles below the earth's surface.

Locking Two Stands of Drill Pipe into Place; Right, Derrick of World's Deepest Well

Parachute That Opens Instantly and Intended for Leaps from Very Low Altitudes; It Is Shown as It Was Tested with a Dummy

PARACHUTE FOR SHORT JUMPS IS SUCCESS IN TESTS

Increased safety for aviators is promised in a parachute intended particularly for emergency leaps at low altitudes. In tests, the silken umbrella opened instantly when dropped from an airplane flying less than 100 feet above the ground. Ordinarily an altitude much greater is required for a parachute jump because of the time it takes the device to open.

MOONLIGHT AFFECTS THE RADIO SAME AS SUNSHINE DOES

Moonlight, like sunlight, interferes with radio reception. Dr. Harlan T. Stetson, of Ohio Wesleyan university, has reached this conclusion after analyzing the strength of signals between Chicago and Boston for several years. He found the reception improved about 100 per cent when the moon was below the horizon. This is believed due to a negative electrical charge on the moon. Another experimenter also established independently the unfavorable influence of the moon on the reception of radio waves of 4,000 kilocycles. Radio waves travel long distances only because they are reflected from a layer of electrified particles in the upper atmosphere about seventy miles from the earth. This radio mirror, known as the Kennelly Heaviside layer, is pushed downward when the moon is passing overhead, which produces somewhat the same sort of disturbance in radio transmission as that made by sunlight, which constantly bombards the earth's atmosphere with electrons, these in turn tearing apart the positive and negative charges of the atmospheric molecules. If the sun is more active on occasions, as when large spots appear on its surface, the degree of ionization increases, producing about the effect of lowering the atmospheric layer. The decreased strength of the reception at present over that experienced in the early days of broadcasting, and the vastly poorer reception in the daytime as compared with night, are both due to the changing effect of the sun's rays on the earth's atmosphere. In addition, however, both day and night reception vary from time to time for what has often seemed no good reason at all. It is now believed the cause may rest in the sun's atmosphere itself.

¶Our Bureau of Information is for your benefit. Use it as often as you please.

SHIP "CANCER" STOPPED BY ELECTROLYSIS DIVERTER

"Cancer" or electrolysis which eats away stern bearings, propellers, propeller shafts, and rudders of ships is stopped by an electrolysis eliminator now available for installation on any vessel. The device, slightly concave and circular in shape, is usually attached in pairs to the bottom of the ship, with a copper wire hookup to the engine and water-circulation system, and also to the stern bearing and stuffing box on the propeller shaft. It is claimed many trips to drydock made by salt-water craft are due to the fact that the circulating water system, with its brass and iron piping and salt water for an electrode, constitutes a perfect galvanic battery. No effort is made to alter this fact in the device, but the flow of current is diverted. With the eliminator installed, a removable core or electrode is the only article eaten away.

OUTBOARD BOAT WITH WINGS SETS SPEED RECORD

Equipped with a pair of stubby wings, an outboard-motor boat driven by an Italian recently set a speed record of 45.68 miles an hour for that type of craft at Gardone, Italy. The boat, with its pointed bow and short wings on each side, bears a remarkable resemblance to a tiny airplane when racing.

Outboard-Motor Boat with Stubby Wings That Set Speed Record

Workmen, Equipped with Life Belts as Protection in Case of a Fall, Removing Power Cables from Brooklyn Bridge

LIFE BELTS GUARD WORKERS HIGH UP ON BRIDGE

Workmen, wearing life belts and supported by stout ropes, recently accomplished the dangerous task of removing three lead-sheeted high-power cables from Brooklyn bridge. They carried 6,600 volts, but present-day requirements compelled substitution of cables working at 27,000 and 33,000 volts.

SHELL THAT ILLUMINATES SEA REVEALS RUM RUNNERS

Coast guardsmen are experimenting with a bomb-signal gun designed particularly to reveal the operations of rum runners and thwart them. The gun is so powerful that when fired to windward it can be heard a mile away and is so equipped that it can also discharge shells with 600,000 candlepower, which will light up the sea for miles around. Although the bombs may explode over rum boats or other vessels, fragments will not injure the crew of the boat that is signaled.

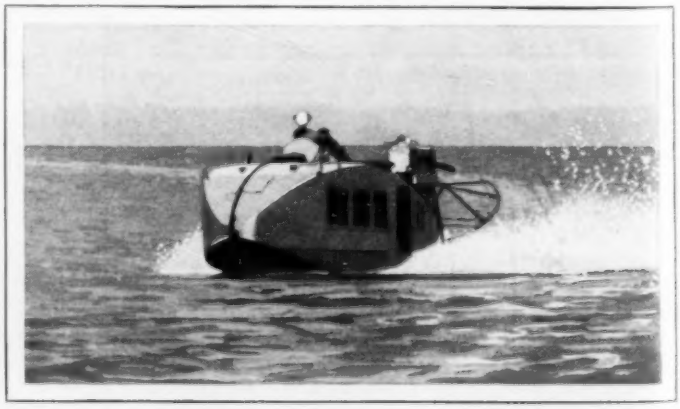
Simple Instrument Used Alternately as Receiver and Transmitter in Sending Pictures by Wire, and an Example of Its Work

PICTURES SENT AND RECEIVED BY SAME TELEGRAPH UNIT

Transmitting pictures by wire has now reached a stage where the person with only a limited knowledge of the process involved can both send and receive photographs. A compact German instrument, known as a "Chemograph," can be used alternately as a receiver or transmitter and is simple to operate, since the pictures require no treatment before transmission and any original can be sent as long as its dimensions fit the large drum of the receiver. At the receiving end no chemical development of the transmitted picture is required. Sending can be done by cables, overhead lines or by radio-telegraphy and all that is required for wire transmission is a good telephonic connection between transmitter and receiver. When operating as a transmitter, the set, after being synchronized with the receiver, works through a photo-electric cell which converts variations of light into variations of current. When used as a receiver, the optical feature is dispensed with, and a small tracing pencil takes its place.

GLIDE BOAT KEPT LEVEL BY STEPS IN BOTTOM

For high-speed transportation on rivers and lakes, a German engineer has made a glide boat of radical design. Steps have been cut into the bottom of the craft so that, even at a speed of more than twenty-five miles an hour, the boat remains horizontal in the water where the sterns of others tend to rise. The steps also give the craft greater stability, permitting more passengers to ride, and since it has no keel in the ordinary sense, it can travel in shallow waters. It averages thirty-nine miles an hour.



Glide Boat with Steps in Bottom to Keep It Horizontal at High Speeds; It Can Travel in Shallow Water as It Has No Keel

FIRE IS NOW GREATEST ENEMY OF SHIPS

Ships now are better guarded against the action of their natural enemy, the sea, than formerly, but recent statistics assembled for Hamburg shipbuilders show that the risk of fire has been very considerably increased. Last year 113 vessels of 119,409 tons were reported to have been totally lost, the character of the cargo unknown, and thirty-eight, of 114,847 tons, carrying general cargo. General cargo is usually shipped in regular liners, apparently being considered safer there than in a tramp vessel. However, it appears the very claim to regularity of the modern liner may be a danger, because the strict observance of time schedules often causes storm warnings or news of low water levels to be disregarded. Added to this is the miscellaneous goods such a ship carries, which cannot be loaded or stowed to best advantage. Fire is now one of the most frequent and costly of all forms of casualty. Before the war nearly every fourth ship of the world's mercantile marine was reported damaged, but recently almost every second vessel was included in the returns.

HACKSAW FITS ONE-INCH SPACE AND HAS RIGID FRAME

Having a throat just deep enough to accommodate the blade, a hacksaw frame now being offered enables cuts to be made in a space offering hardly more than an inch clearance. This construction also results in improved balance and rigidity, making the frame especially useful for

Hacksaw Frame That Operates in Small Space

cutting small pipe as it has no tendency to wabble on shallow cuts. The blades can be strained tighter with less danger of breaking, and the cut can be made with one hand, leaving the other free to steady the work.

Powerful Searchlight Projecting a Sign Advertising the Army onto Empire State Building, the Tallest Skyscraper

SIGN PROJECTED ON BUILDING BY POWERFUL SEARCHLIGHT

Transforming the world's tallest skyscraper into an illuminated billboard, a powerful searchlight was employed recently to project words onto the side of the Empire State building in New York. The light cast the words "The United States Army Builds Men" onto the wall.

MECHANICAL EYE FOR PLANES SEES TWO MILES IN FOG

For the guidance of aviators, a mechanical eye has been developed which is able to "see" for a distance of two miles in an average fog. The apparatus is designed to be set on the tail of a ship, sight an airway light through the fog and reproduce on the aviator's dash a synthetic beacon. The artificial dash beacon is in two parts. One shows the flyer whether the airway light is to left, right or straight ahead. The other signal shows whether he is approaching it or moving away, and the two readings, with his altitude instruments, furnish a landing guide.

Using a Modern Divining Rod to Which Headphones Are Attached in Locating Electrical Wiring Hidden under Floors

DIVINING ROD QUICKLY TRACES CONCEALED WIRING

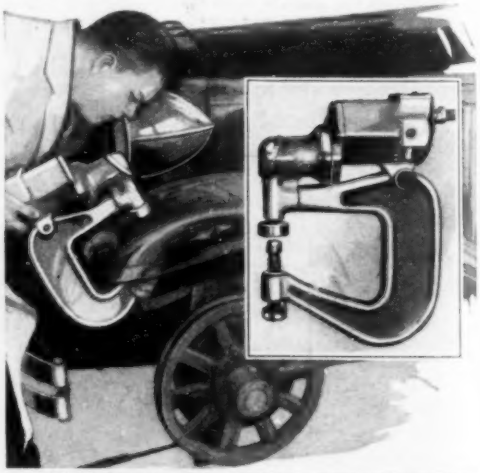
Electric wiring under the floors of office buildings, serving desks with light, telephone and buzzer systems, is often difficult to locate when repairs are necessary. For this purpose, a modern divining rod, known as a divinator, has been produced. It is a small tubular instrument to which are attached a pair of earphones. The operator uses the headset and moves the tube about the floor. When it crosses wiring, it transmits a definite and readily recognized sound, and when it is above an outlet, another distinct sound is heard.

WAYS TO SAVE WILDFLOWERS SOUGHT BY SCIENCE

Establishing sanctuaries and protected areas for wildflower species threatened with extinction is not sufficient to assure their survival. The special needs of each group of plants, particularly their soil preferences, must be studied and adjustments made accordingly before these flowers will thrive. This is the opinion of Prof. Edgar T. Wherry, who has made a study of wildflower conservation. It is useless, he observes, trying to grow trailing arbutus, moccasin flower and similar plants in neutral or alkaline soil, because such plants are sure to die in a short time unless acid-reacting humus is provided and maintained. The only sure way to make an acid test is with dyes which change color with various degrees of acidity. Weeds also will kill wildflowers.

ELECTRIC FENDER TOOL SPEEDS AUTO REPAIR

Removing dents and bumps, and re-forming beads, flanges and curves, an electric fender straightener does repair work of this nature faster than it can be performed by hand methods, and accomplishes some operations that mechanics cannot do. After the tire is removed and the fender cleaned and oiled, a bending iron and roughing-out hammer are used to get it into approximate alinement, and a fender jack is employed to raise or lower it. The straightener is then applied. This outfit consists of a power unit and two frames with twelve and seven-inch reaches. In using one of these frames, 2,000 pounds' pressure is applied 1,400 times a minute, literally squeezing the damaged fender back into normal position. Special dies aid in reshaping the crown and re-forming beads and flanges, after which it is ready for finishing.



Electric Fender Straightener Which Takes Out Dents Faster Than It Can Be Done by Hand

How to Know Jewels

WHEN you see a handsome diamond or an emerald, how can you gauge its value?

Dr. W. F. Foshag, distinguished scientist connected with the world-renowned gem collection of the National Museum, Washington, says that it is fun to know about jewels and he explodes a lot of widely accepted precious-stone fallacies like the following:

That colored diamonds are virtually worthless compared with the clear-white, transparent varieties; that an expert can judge a gem's trueness and worth at a mere glance with the naked eye; that common oysters can make pearls of tremendous value; that the prolonged contact of a pearl with the human body will bring a "dead" pearl back to life and renew its desired brilliancy; that certain jewels, notably opals, bring a long trail of bad luck and even tragedy to their possessors.

Top, Original Model of Royal Crown of Queen of Rumania Made of Gold and Set with Precious Stones; Below, Corsage of Rose, Green, Yellow and White Diamonds Made for Catherine of Russia

"First of all," explains Doctor Foshag, "many of us need a little elementary information about just what constitutes jewel value. This mysterious something varies considerably according to the kind of precious stone, but we generally can define gem beauty as including, or included in, the factors of rarity, hardness, transparency, color and play of color.

"The first two factors are important in evaluating all jewels. Rarity almost invariably spells a high market price, while a gem's hardness goes along with the essential quality of wear resistance. Transparency is vital in judging a colorless jewel, and color and play of color have prominent roles in the beauty of such deep-tinted gems as the blue sapphire, red ruby and green emerald.

"But let us examine, one by one, the 'big six' in the jewel world, generally accepted in the following order as the most

Above, Part of the Collection of the Romanoff Tsars; Left, Pearl Necklace Valued at $1,500,000

valuable precious stones: emerald, diamond, ruby, pearl, sapphire and opal, and try to determine just why they hold their enviable distinction.

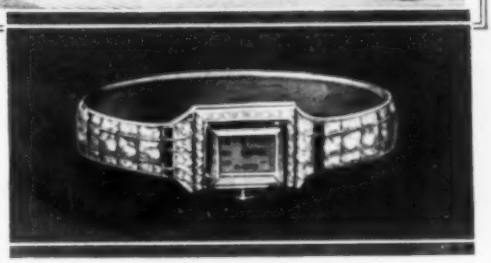
"Strange, isn't it, that the finest type of white diamond, purest of all the precious stones, is not the most valuable gem? However, it rates second only to the flawless emerald, which, without setting or other frill, sells sometimes for as much as $6,000 a carat.

"Perhaps stranger even than this fact, is the situation that the emerald, queen of all stones, depends for its remarkable beauty largely upon certain foreign substances: a tiny amount of chromium and probably a little vanadium—both rare elements. However, it is seldom that you will see a flawless emerald, which fact explains that gem's great value. The name emerald, by the way, is given only to a superfine variety of the lovely stone known as beryl, which comes in various shades but in this particular case must be of purest possible rich green.

"Colored diamonds are also numerous and they, too, owe much of their beauty to impurities, including probably a bit of iron. Which is a reminder of our first common fallacy—to the effect that colored diamonds are necessarily not as valuable as the clear-white varieties. This is far from true. Indeed, many pigmented diamonds possess all the luster and fire of the best transparent kinds, and, besides, they have the added beauty of a rich color, like emerald-green, ruby-red or sapphire-blue.

"Such gems, classed as 'fancy stones' to distinguish them from the plain whites, command highest prices. In fact, a perfect blue-white diamond will sell for only about $1,000 a carat while fancy stones of similar size will rate up to $3,000 a carat.

"On the other hand, there are considerably more colored diamonds which are



Above, Pieces of Medieval Art of Almost Priceless Value; Right, Wrist Watch Valued at $20,000; Its Crystal Is an Eight-Carat Diamond

far inferior to colorless and genuine fancy varieties. Among these abound unsightly pigments like straw-yellows, flecked greens and muddy browns, owing their origin probably to the inclusion of foreign mineral materials.

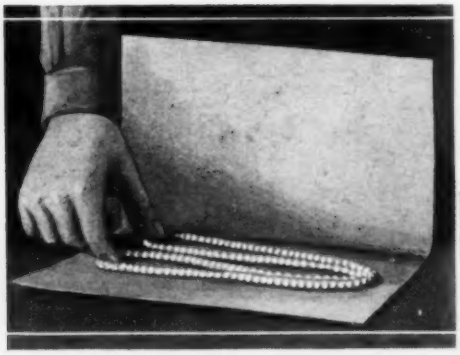
"Sometimes the widely heralded 'black diamonds' are classed as fancy stones, but usually they sell for considerably less than the pure whites. The characteristic blackness is due no doubt to clouds of minute carbon inclusions. There are two chief kinds of black diamonds. The one is a dense, opaque stone, employed widely for drilling purposes because of its exceptional hardness. Never is it used as a gem but it is indeed the hardest stone nature knows.

"Like the emerald and fancy diamond, the ruby depends on impurities for its glorious color—however, such a tiny amount, probably of the metal chromium, that you can't detect it chemically. The sapphire also owes its color—a lovely blue—to foreign matter, such as titanium, a rare metal, or possibly a combination of titanium and chromium.

"Finest rubies will sell up to $3,000 a carat, while sapphires rate much less money because they are far commoner. Both the ruby and sapphire belong to the corundum family of minerals, the corundum, next to the diamond, being the hardest of all stones.

"Major factors in pearl values are size, shape, orient (luster) and color. But giant pearls are so rare that your ten-grain stone may be worth several times less than a twenty-grain pearl. Perfectly round ones bring prices far greater than irregularly shaped ones, but a good pear-shaped pearl is superior to all other shapes. Delicate pinks, golden yellows and blacks are the most popular shades.

"There's certainly a great difference in pearl values. A striking example exists in the case of the famous President Buchanan pearls, consisting of a string and two loose drops of about the same size, one pear-shaped and the other round. At



Above, Freshening "Dead" Pearls by Placing between Sheets of Moist Blotting Paper; Right, Glass Bead Necklace 3,000 Years Old

a glance you'd probably guess that one of the drops was slightly more valuable because somewhat brighter. The truth is, the brighter one, of perfect pear-shape, is valued commercially at more than the other drop and the entire string put together. The reason is that you could easily duplicate the round drop as well as the string; but luster and symmetrical shape virtually forbid the duplication of the higher-quality drop.

"Don't accept the much advertised notion that America's common oyster can make pearls of great value. True, the object derived from our bivalve is a genuine pearl, but it lacks beauty and hence has virtually no value. The Yankee oyster makes its pearl out of the same material it uses to build its shell—layers of carbonate of lime and conchylin. But to make a precious stone, it would have to have more iridescent materials so as to give the much prized luster.

"Another foolish fallacy holds that the prolonged contact of a pearl with the human body will bring a 'dead' one back to life. A variation of this fable is that if you don't wear your pearl most of the time, it surely will die. Now, pearls will lose their luster, to be sure, but the 'death' usually takes between 150 and 200 years.

"How these notions originated is quite understandable. A lady takes a rope of pearls out of its case after a long interval and notices that they are dull-looking. She puts them around her neck and apparently they freshen up immediately. The truth is that contact with the moisture of the skin has brushed away much of the dust adhering to the gems, so that naturally they will become brighter.

"Here's the reason pearls 'die.' They are made up by Mother Nature in an entirely different way from all other precious gems, consisting of alternate layers of mineral and animal matter, the former being carbonate of lime and the latter conchylin (marine-shell material of high iridescence). In conchylin is a considerable amount of water. As time goes on, the water dries out and the gem loses its luster.

"If your pearls are dull but not entirely 'dead,' you probably can freshen them up almost immediately by simply putting them away, when not in use, between two sheets of moistened blotting paper. This way of treating them offers enough moisture to be effective usually for a period of several months.

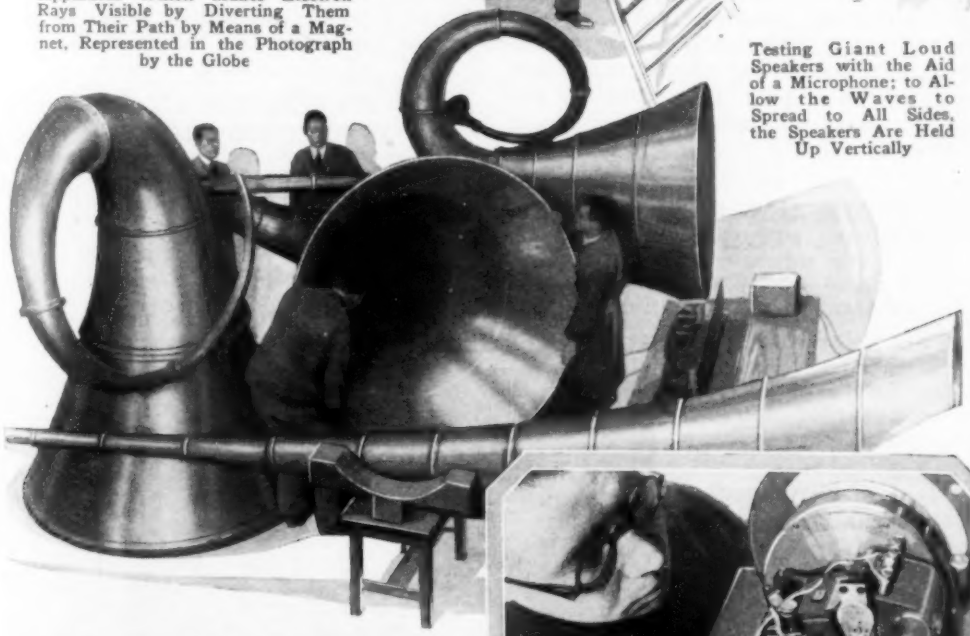
"Considering the opal, last of the 'big six' precious stones, you find it classified as a quartz, but differing from that mineral in that the opal is never crystallized and contains a tiny amount of water. This jewel is comparatively soft and therefore virtually unmountable, but to some extent it makes up for this deficiency by a spectacular play of brilliant colors. Oftentimes a single opal will exhibit brilliant green, yellow and red flashes. The finest of these stones will sell for as high as about $300 a carat.

"Volumes have been written to the effect that certain jewels, notably opals, bring a long trail of bad luck and even tragedy to their possessors. Of course this is absurd, but there is a grain of truth in the notion, for when a person possesses a gem of very great value he is naturally in line for the greedy and cunning devices of rogues who may stop at virtually nothing in an effort to steal the treasure."

THE WONDERS OF TOMORROW AS GLIMPSED TODAY

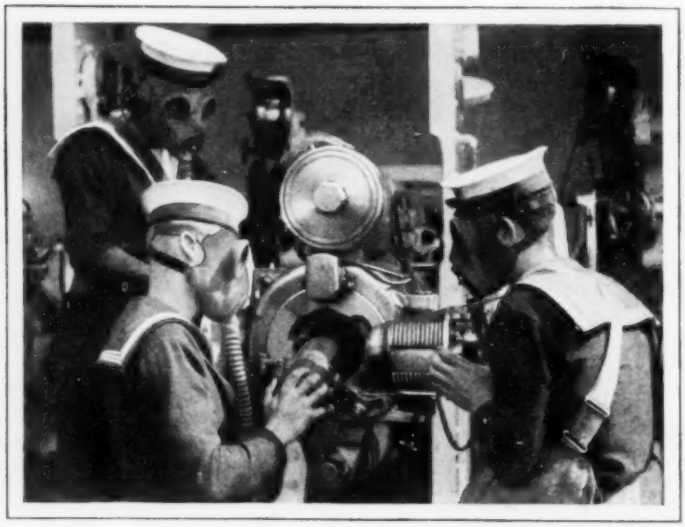
Apparatus Which Makes Electron Rays Visible by Diverting Them from Their Path by Means of a Magnet, Represented in the Photograph by the Globe

Testing Giant Loud Speakers with the Aid of a Microphone; to Allow the Waves to Spread to All Sides, the Speakers Are Held Up Vertically



Above, Huge Loud Speakers Built on Entirely New Lines and Curves in Order to Attain a Purity and Volume of Sound Hitherto Impossible; Right, Delicate Apparatus Constructed to Measure Vibrations; It Was Built to Record the Vibrations in the Hull of a Faultily Constructed German Cruiser so the Origin of the Vibrations Could Be Found and Steps Could Be Taken to Correct the Errors

© Weltrundschau



© P. & A. Photo

Gun Crew of British Navy Wearing Gas Masks with Which All Gunners Have Been Equipped as Protection in Chemical Warfare

GAS MASKS WORN BY GUNNERS OF THE BRITISH NAVY

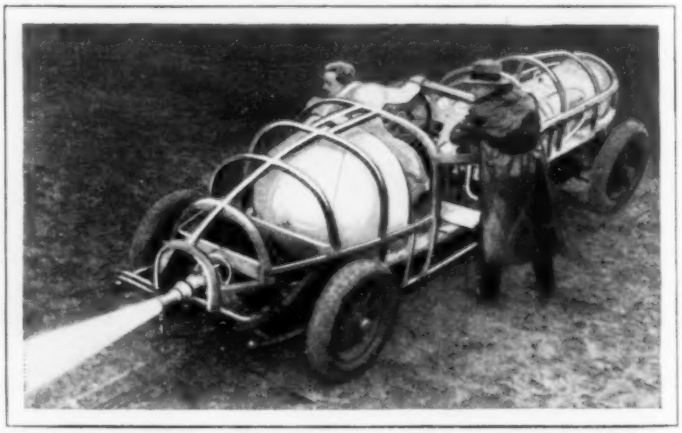
All gun crews of the British navy now are equipped with gas masks as a protection against bursting shells and other forms of gas attack. The masks are expected to enable the gunners to remain at their stations in the face of a gas barrage.

PRACTICE TANK FOR OARSMEN TO HAVE FLOWING WATER

Plans for a new gymnasium at Yale University call for installation of two tanks in which full crews can ply their oars in live water under conditions approximating those of a real race. Many problems were faced in planning such an arrangement and hydraulic engineers constructed a miniature tank to work out some of the difficulties. The main problem was to force a steady, controllable flow of smooth water past the seats at a speed variable up to eight miles an hour. A steady flow was obtained by constructing a box weir at the head of the tank, but it was found that water flowing at such a speed in a shallow tank had a tendency to pile up in waves. A system of vanes was then installed in the water-delivery slots that would "comb out" the water and make it flow smoothly. The new tanks are to be sixty feet long and half that wide. Water is to be delivered through two mains, five feet in diameter, each equipped with a rotary pump. Sliding seats like those used in shells will support the crew who will use regulation oars. The unskilled oarsman, who fails to start his pull at the instant his oar enters the water or who does not feather properly, will "catch a crab" just as though he committed the same fault in a racing shell.

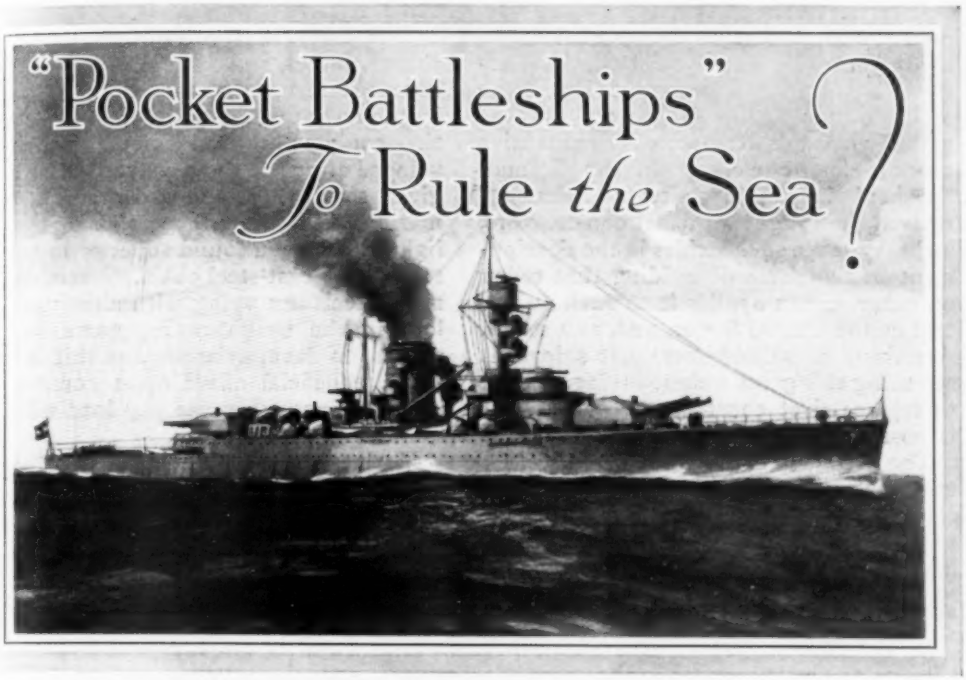
AUTO PROPELLED BY ROCKETS IS SUCCESS IN TESTS

Successful tests recently were conducted in Berlin with an automobile propelled by rockets. The rocket car is of unconventional design since the engine is replaced by the propulsive explosives. It is driven by the firing of successive rockets.



Rocket Auto Recently Tested in Berlin; Propulsive Power Is Supplied by the Successive Explosions of a Series of Rockets

"Pocket Battleships" To Rule the Sea?



Germany's First "Pocket Battleship," a 10,000-Ton Armored Cruiser; Her Hull Is Electrically Welded and Her Eight Diesel Motors Develop a Total of 50,000 Horsepower

By JOHN WARREN WOODLEY

THE London naval treaty of 1930, ratified by the United States, Great Britain and Japan, in challenging navies to "reduce and keep fit," has resulted in an entirely new order of shipbuilding, both naval and mercantile.

That treaty definitely restricted the individual tonnage and maximum gun caliber allowed in each type of man-o'-war for the three nations and thereby focused attention on the problem of saving weight. At the same time, the treaty limited the total tonnage the nations might build in the different classes of warships. Naval designers, therefore, were faced with laying out lines for efficient "small" ships so that the greatest number under the total tonnage allowance might be constructed.

The ingenuity of navies in meeting this challenge to reduce and keep fit has shown its effect on merchant-marine vessels, for where a naval ship can pare hull tonnage and thereby add more guns or armor or speed, a merchantman can shave off weight to be applied to increased cargo or passenger capacity.

Weight saving in the American navy started with experiments on its cruisers authorized in 1929. These were restricted to 10,000 tons each, and eight-inch guns. To private shipyards securing contracts for these greyhounds of the sea, cash bonuses were offered for production of weight-saving materials or methods, provided efficiency were not sacrificed.

The navy itself concentrated every effort on the "Pensacola," second of the 10,000-ton cruisers, which was to be constructed at a government navy yard. Nine hundred tons, or almost nine per cent of the ship's total weight, were eliminated from the original plans and diverted to increasing the "Pensacola's" offensive and defensive qualities. This weight saving was accomplished by:

A general use of electric welding in place of riveting.

The use, wherever possible, of aluminum paint instead of oil paint; and

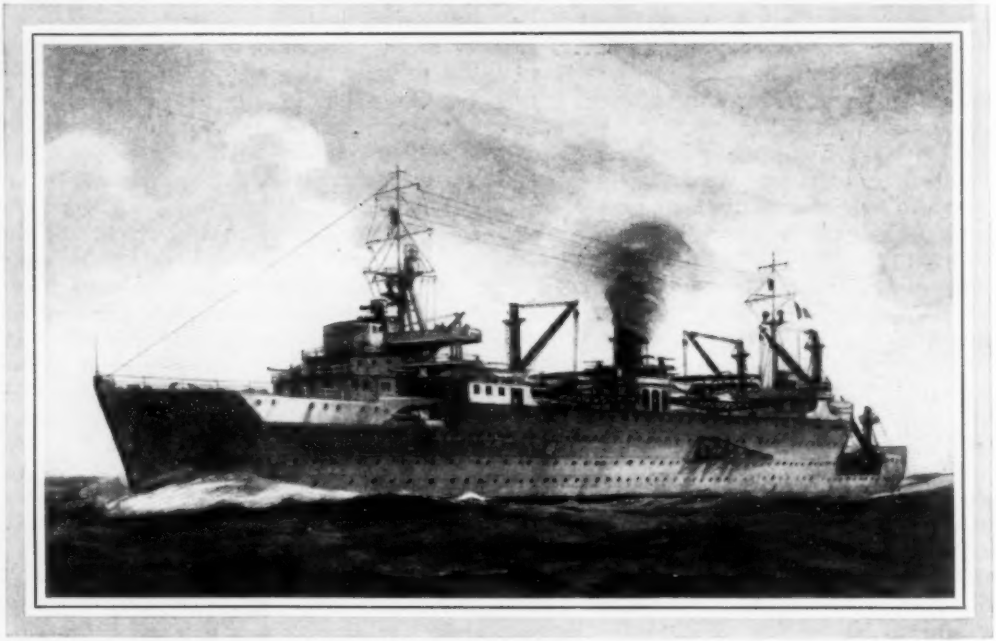
The utilization of aluminum alloys, aluminum foil, and corrosion-resisting steels for interior and exterior fittings in place of rolled or cast steels hitherto employed.

Electric welding was undertaken successfully in the United States at the time of our entry into the world war. Afterward, however, it was neglected until the design of our new 10,000-ton cruisers was actually started. Rumors of the extensive use of electric welding in the German "pocket" battleship "Ersatz Preussen" revived the interest of naval constructors, and they made such strides in the development of this form of welding that today no other nation applies it to such an extent as the United States, and, as a result, American naval and merchant shipyards are using this great weight-saving method to replace rivet construction wherever it is possible.

The second means of diverting weight to military uses in the "Pensacola"—aluminum paint for interior ship use—has now been made general throughout the naval service. Less than half the weight of oil paint, it resulted in the case of the "Pensacola" in a saving of 80,000 pounds.

In the third category of modern ship construction—use of alloys lighter than rolled or cast steel—much has been accomplished and research still continues. So-called stainless steel, with but sixty per cent the weight of cast steel for the same relative strength, is now standard in the navy in the form of structural shapes, plates, rods, bolts, nuts and forgings. Wire rope of this steel, first used by the navy in submarines, is now regulation equipment. Dielock steel chain, developed at one of the navy yards, has been given service tests aboard cruisers, submarines and minesweepers, and, though lighter, has been found superior in tensile strength to cast-steel chain. Special-treatment steels are vying with aluminum alloys in the weight-saving game so important to naval aviation, and this is having a beneficial effect upon commercial aviation, increasing the pay load without sacrificing safe strength.

Marine-engine construction is feeling the modern trend. Investigations of a hardened copper alloy to replace heavy phosphor-bronze alloys used in marine pumps are under way. Bright aluminum foil in several layers as a pipe covering has proved an excellent heat-insulating material and is more than 500 per cent lighter than the asbestos and canvas previously utilized. Successful stainless steel forgings have been made for high-speed machinery parts. Satisfactory tests are being conducted on light Diesel engines.

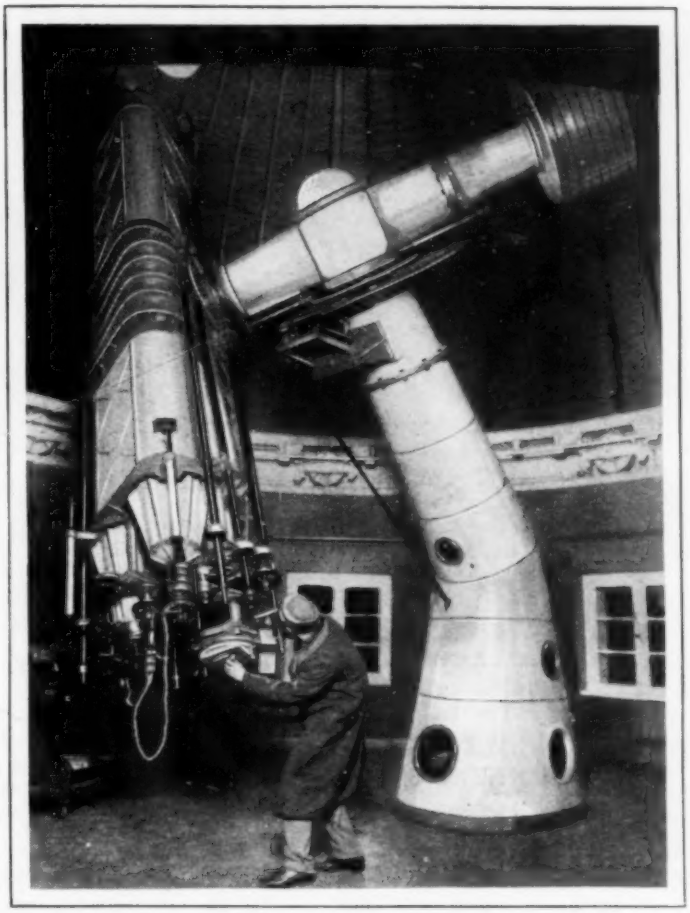


The "Commandant Teste," a 10,000-Ton Wall-Sided Floating Hangar; She Is Intended to Launch Seaplanes from Catapults, and to Hoist Them Inboard from the Ocean by Means of Derricks

Where merchant-marine Diesels weigh from 200 to 300 pounds per horsepower, aircraft Diesels, developed for military use afloat and ashore, weigh from two to three pounds per horsepower. Research efforts are being directed by the navy and commercial manufacturers toward bringing down the weight of Diesel engines for submarine use, and the success of this experimentation will further the progress of "conditioning" both naval and merchant-marine ships.

STRESS ON PLANE PROPELLERS IS SIXFOLD

Airplane propellers probably endure more different kinds of severe stress simultaneously than any other members of equivalent size and weight in industry. When a plane is in straight flight there are at least five major loads acting on the blades, and in turning another is added. First, there is bending, induced by the thrust of the propeller as it pulls the ship forward. Next come the centrifugal loads that struggle to tear the blades from their sockets as the tips slash through their circular course at speeds often in excess of 500 miles an hour. Also, because of the aerodynamic action of the blades, they are given a twisting stress that tries to turn them in their sockets. In addition to the two centrifugal loads and the two torques, the propeller is subjected also to vibrations transmitted through the crankshaft, and when the ship turns off its course, another stress is added, due to the gyroscopic action of the spinning blades. In addition abrasion, rain, cold, and even small particles of rock enter into the picture of forces.



Business End of Huge Telescope in the German Observatory at Babelsberg; It Is Equipped with a Triple Photographic Refractor

TELESCOPE LIKE BIG NAVY GUN IN GERMAN OBSERVATORY

One of the best equipped observatories in Germany is located at the Berlin university at Babelsberg where the most modern astronomical apparatus is installed. The telescope is so huge that it resembles one of the guns of a battleship.

PARAFFIN BATHS FOR ORANGES

Oranges and other citrus fruits are being passed through a bath of liquid paraffin before they are sent to market by one California shipper. The fruit emerges with a thin, glossy coat that not only makes it more attractive to the eye but preserves it from decay or softening almost indefinitely.

Automatic Golf Tee for the Driving Range, Which Places a Ball in Position to Be Hit When Plunger Is Pressed with Foot

TEE FOR GOLF DRIVING RANGE ELIMINATES STOOPING

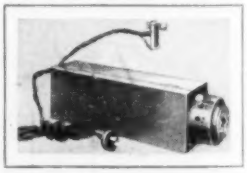
Stooping to place every ball in position on the golf driving range now is eliminated by the use of an automatic tee operated by a foot plunger. The supply of balls is contained in an underground tube. Pressing the plunger raises one ball to the tee, the height of which may be adjusted to suit the player. The automatic tee enables faster driving, and allows the player to retain his swinging stance.

NEW DAM FOR PANAMA CANAL TO HELP TRAFFIC

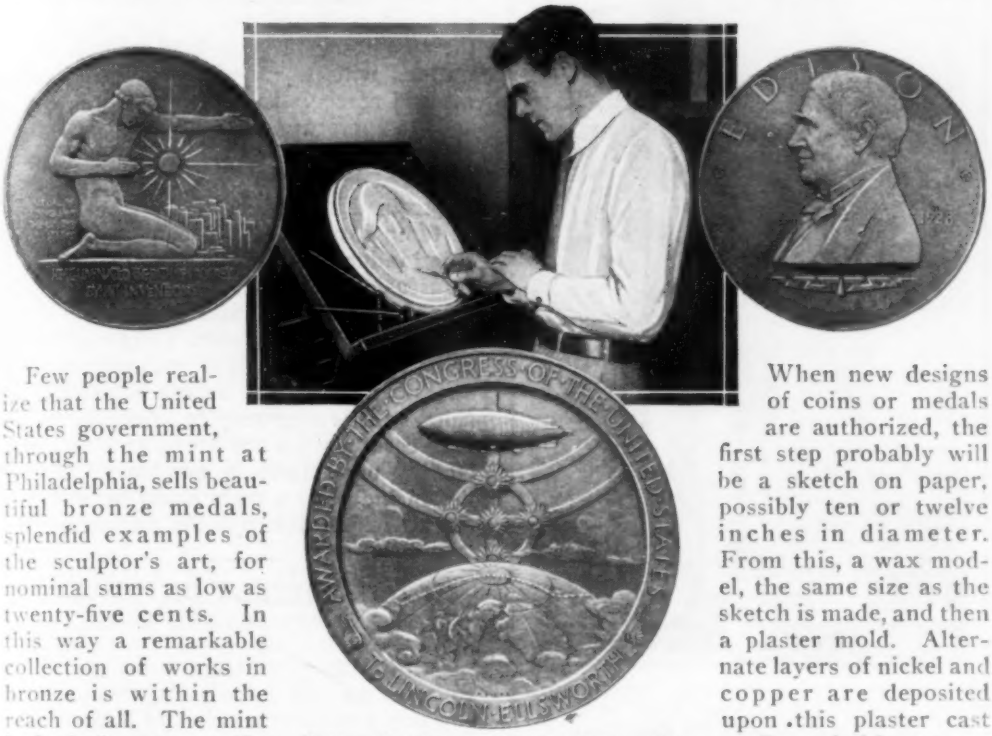
Steady growth of traffic through the Panama canal, expected to increase at the rate of 1,000,000 tons a year, is responsible for government plans to construct another dam twelve miles above Gatun lake. The project includes a dam 2,700 feet long and thirteen small saddle dams, and will cost $15,500,000. It will be known as Madden dam and will insure a reserve water supply sufficient to care for all canal traffic for the next century. Useful reservoir capacity in Gatun lake is 32,000,000,000 cubic feet and the new reservoir, to cover twenty-one square miles, will add 22,000,000,000 cubic feet for the operation of locks, and at the same time will help control floods on the Chagres river and supply hydroelectric power for the Canal Zone. During the last three years, 6,000 vessels have passed through the canal annually. The net tonnage has been over 29,000,000, the cargo tonnage more than 29,600,000 and the tolls about $27,000,000 a year. The United States leads in traffic with more than forty-six per cent and Great Britain is second. Two-thirds of the ships pass from west to east, carrying principally mineral oils, lumber, ores, nitrate and wheat from the Pacific, and iron and steel manufactures from the Atlantic coast. The reservoir level of Madden dam will be 240 feet above the sea.

FIRE AND BURGLAR-ALARM UNIT OPERATED AUTOMATICALLY

Fire and burglar alarms for the home or office have been combined in one simple unit that is automatically operated. The alarm is in the form of a motor-driven siren, and the outfit is quickly connected to the building's electric circuit. The fire alarm is operated through thermostatic switches attached to the ceiling, which make contact when room temperature rises to 120 degrees, causing the siren to sound continuously. The same siren is operated through burglar-alarm switches placed in windows or doors, contact being made when a window is raised or a door opened. The alarm system may be obtained for direct or alternating current and also can be run by batteries.



BEAUTIFUL MEDALS ARE OFFERED BY UNCLE SAM



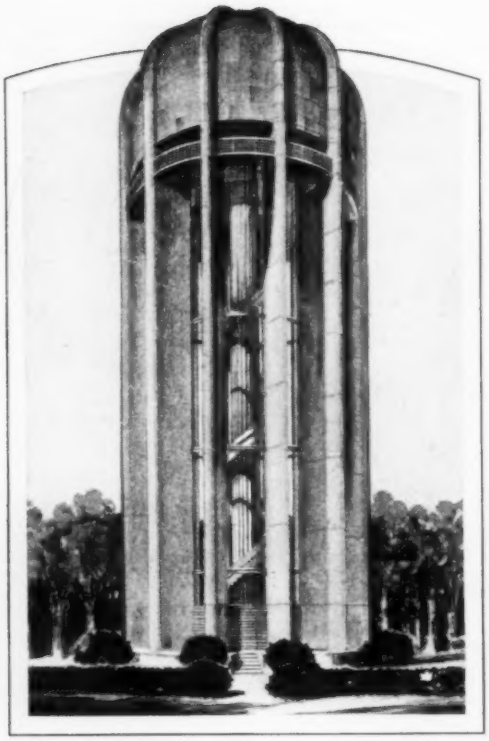
Making Model for a Medal and Examples of Some of Beautiful Designs Turned Out by United States Mint

Few people realize that the United States government, through the mint at Philadelphia, sells beautiful bronze medals, splendid examples of the sculptor's art, for nominal sums as low as twenty-five cents. In this way a remarkable collection of works in bronze is within the reach of all. The mint is looked upon as the place where the coins of the nation are manufactured, but, in addition to these, the medals of the army and navy are struck, as well as medals commemorating each of the presidents, some of the secretaries of the treasury, and special events in the history of the nation. Many smaller countries do not have mints of their own, and the Philadelphia mint also coins money for some of these, competing for this work with the French and English mints. The medals commemorating the presidents are particularly handsome works of bronze, three inches in diameter, and are sold for $1. Those of the earlier presidents were designed by noted sculptors in Europe, but the later ones were made by American artists. Presidential medals were first made in silver, and were given to Indians as peace offerings by the war department; hence they became known as "Indian peace medals." Naturally the work of the mint is enveloped in secrecy. No photographs may be taken, and rifles may be seen conveniently placed on all walls.

When new designs of coins or medals are authorized, the first step probably will be a sketch on paper, possibly ten or twelve inches in diameter. From this, a wax model, the same size as the sketch is made, and then a plaster mold. Alternate layers of nickel and copper are deposited upon this plaster cast until a rigid copper facsimile of the coin or medal, many times enlarged, is obtained. This large replica is then put into a delicate machine, imported from France, which works on the principle of the pantograph, and accurately cuts a soft steel die to the size required by the actual coin or medal. So delicate is this machine that the sun shining on it will cause trouble. The master die is then heat-treated and hardened.

SUGAR FROM COCONUT PALMS

Ceylon producers are making an effort to develop a market in the United States for palm-sugar, or "jaggery." This product is made principally from the sap of the flower of the coconut palm, and sometimes from the pamyra palm, and tastes somewhat like maple sugar. Tappers string ropes between the palm trees, one about five feet above the other, then make their rounds by walking the ropes between trees, steadying themselves with the upper strand.



Graceful Design for Water-Tank Tower Which Won First Prize in International Competition

TOWER DESIGN IMPARTS GRACE TO CITY WATER TANKS

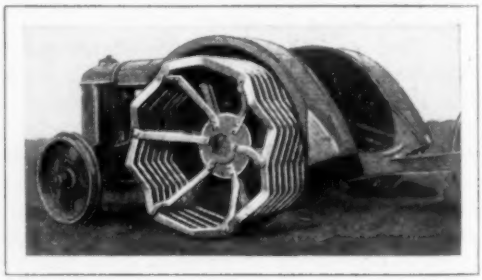
Beauty and symmetry of line are being imparted to water tanks, as shown by the accompanying illustration. This water-tower design by Eugene Voita, of Chicago, won first prize in an international competition to develop a general æsthetic improvement in the character of elevated steel water tanks. The graceful lines, which give the tower the appearance of a huge monument, were considered the best among designs submitted by 152 contestants who presented plans for a typical 200,000-gallon tank for municipal service.

MALARIA MOSQUITO BEING BRED TO HELP CURE PARESIS

Artificial breeding of malaria mosquitoes in quantities sufficient to supply state hospitals with this cure for paresis is now being attempted by the federal public health service. The malaria cure for the brain malady is being used throughout the United States with the result that from fifteen to thirty-five per cent of the sufferers from this hitherto incurable disease get well and are able to return to their homes. The pure-bred malarial mosquitoes will be raised in cages of fine-meshed screening under scientific control as to temperature, humidity and nutrition. When called for by hospitals, they will be delivered in person by a technical assistant trained in keeping the insects at proper temperatures. At present, malaria is being induced in paresis patients by blood transfusions, but scientists have decided it will be easier to raise mosquitoes than look for malaria patients. Only one of the three species of malaria mosquitoes produces a disease that brings beneficial results, so it is necessary to select the exact kind carefully for the breeding work. The efficacy of malaria in combating paresis lies in inducing a maintained fever at intervals which destroys the paresis germs.

ZIGZAG WHEELS ON TRACTOR LEAVE NO MARKS BEHIND

Zigzag tractor wheels are being used in England to roll grasslands and slippery surfaces because they do not leave marks on the turf. To the eye the wheels appear to be "waved," but are actually circular in periphery. The tread is formed by the edges of a series of steel rings, equally spaced. These rings are round, but are waved sidewise, so the track presents a series of waves or zigzags. When the roller is in operation, the wheel rings grip the grass surface very firmly. The springy nature of the turf causes slight ridges which are obliterated when the wheel has passed. For very hilly grasslands or for agricultural uses, a special type of wave-wheel roller is used.



Zigzag Wheels on a Tractor Which Roll Turf without Leaving Any Marks in Their Wake

HARDY WILD FLOWERS DEFIED ANCIENT GLACIERS

Plants of the temperate zone may have defied the oncoming ice of the glacial age thousands of years ago, and clung to their hillsides within a few miles of the mountains of frozen water. This possibility is expressed by Prof. Edgar T. Wherry, of the University of Pennsylvania, after a study of geographic varieties of the common moss phlox. He found that the geographic distribution of these phlox varieties makes it appear probable that the slow migration of the plants took place not from south to north but from east to west, parallel with the ice front and within a few miles of it. This suggests that living conditions for temperate-zone plants were not altogether impossible even though it were at the very boundaries of the glacial fields.

LUMINOUS HELMETS PROTECT TRAFFIC POLICE

Paris traffic officers are being equipped with "halos" in the form of luminous helmets as a safety measure so they can be seen easily by motorists at crossings when directing traffic at dark intersections. Stripes of phosphorescent paint are placed on the helmets, and it has been found that the stripes not only protect the policemen but aid pedestrians in distinguishing a gendarme in case of need.

Traffic Officer Wearing Helmet with Luminous Bands so Motorists Can See Him in the Dark

Courtesy, J. V. Hyka

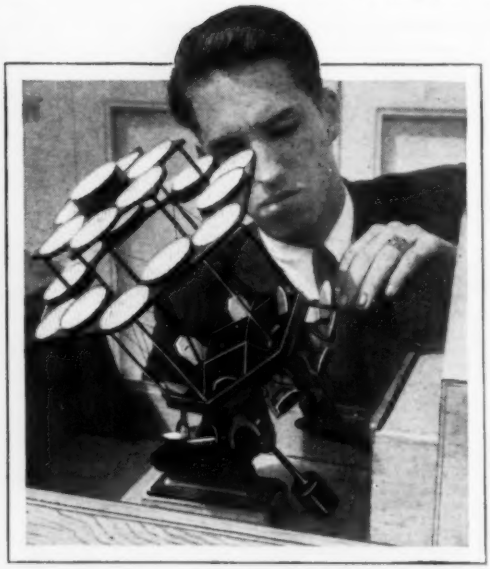
Aerial Lighthouse in Europe Which Serves as Landmark by Day and Flashes Beacon at Night

LIGHTHOUSE ON AIR-LINE ROUTE HAS HUNDRED-MILE RANGE

Lighthouses now are being employed to guide ships of the air as well as the liners of the sea. One large lighthouse, resembling those found along the seacoast in general appearance, is located in Czechoslovakia on the air route from Prague. This beacon has a range of more than 100 miles and serves as a day-and-night guide for the passenger air liners.

FLOW OF BLOOD IS REVERSED TO RELIEVE GANGRENE

To relieve gangrene, the flow of blood in a patient's hands and feet was reversed and the subject has lived for twenty years. The operation was to relieve a disease in which small arteries were affected, the tissue supplied by them dying when it did not receive proper nourishment. Arteries in the legs and arms were linked with the veins, enabling the blood to proceed from the heart through the veins and back through the arteries, thus reversing the normal flow. With the blood flow reversed the patient improved rapidly.

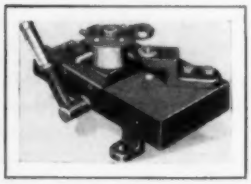


Model of a Solar Furnace Which Concentrates Sun's Heat through a System of Mirrors

SUN'S HEAT IS CONCENTRATED IN SOLAR FURNACE

Operated through a system of mirrors, a solar furnace in model form has been made by scientists of the California Institute of Technology who believe the arrangement is capable of placing eighty per cent of the sun's heat at the disposal of man. It is estimated the latest heat generator will be able to produce a temperature of 4,500 degrees centigrade, which will melt tungsten and turn diamonds into vapor. The apparatus reflects the sun's rays by means of nineteen mirrors to a focus beneath a mounting similar to that used for the telescope at the Mount Wilson observatory. There is no known substance which will remain unchanged when it is subjected to the terrific heat at the focal point.

SCREW-MACHINE PARTS MADE BY DRILL ATTACHMENT

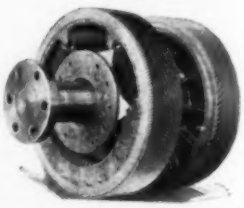


Work that heretofore has required a lathe or screw machine, can be done by a turning and forming attachment for a drill. While the tool accomplishes every turning and forming operation, there are no bearings to wear out, gears to strip or belts to maintain. Any motor that will operate the drill also will run the attachment. In operation, the piece of stock is placed on the drill chuck, the attachment is located with its stock opening directly in line, and is clamped down. The drill is started and, as the stock revolves, the tool is fed in by either a handwheel or a lever. The device works equally well on round, square or polygonal stock.

OIL MANUFACTURED FROM COAL

Oil is to be made from coal by a British firm through a process recently patented, and a plant to handle 1,000 tons a week is being built in England. It is claimed that one ton of raw coal can be treated by the process in each retort in twenty-four hours, and the output is estimated at 10,000 gallons of gasoline, 10,000 gallons of fuel oil and 750 tons of smokeless coal a week, in addition to sufficient gas to heat the retorts.

FLEXIBLE GEAR ABSORBS JOLTS IN DRIVING SHIP

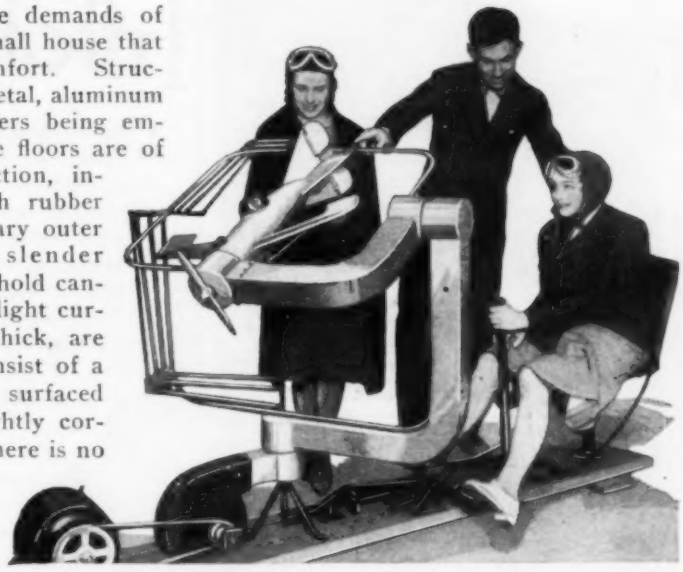


Bumps and jolts which threaten to weaken the mechanical driving units of ships are eliminated by the use of a flexible gear which absorbs the unequal torques, delivering full driving power to the propellers. Increased power and speed are extracted from the exhaust steam discarded by the 3,200-horsepower expansion engine of one large cargo carrier through the use of a 1,000-horsepower, low-pressure turbine, operated at 3,600 revolutions per minute. To compensate for the variations which create thumps, bumps and jolts, the flexible gear, six feet in diameter, is used.

HOME OF ALUMINUM AND GLASS HAS MANY CONVENIENCES

Aluminum beams, steel floors and three-inch outer walls surfaced with aluminum sheets are a few of the innovations in a home of metal and glass that has been

built as an answer to the demands of suburban dwellers for a small house that offers efficiency and comfort. Structural work is entirely of metal, aluminum and steel beams and girders being employed in the frame. The floors are of battle-deck steel construction, insulated and surfaced with rubber and linoleum. The ordinary outer walls are supplanted by slender aluminum columns which hold cantilever beams from which light curtain walls, three inches thick, are suspended. The walls consist of a layer of light insulation, surfaced with aluminum sheet, slightly corrugated to avoid glare. There is no basement, the ground floor being utilized for the entrance, hallway, heating plant and garage. A short flight of stairs leads to the living room, which extends two floors in height and occupies the major portion of the upper stories. A large window of glass, permeable by ultra-violet rays, forms the entire wall space on one side and neon tubes parallel the window tops. The light may be modified to meet the whim of the occupant. The living room is separated from the dining area by a partition which may be moved back to convert the space into one large room. The dining-room table has a rubber top which can be rolled up like a curtain when not in use. Bedroom, exercise room and bath, separated by removable partitions, occupy part of the main floor. A library and a roof garden are other features.



Ground Trainer for Flyers in Which Standard Controls Manipulate a Small Plane as Jets of Air Are Directed against It

GROUND TRAINER FOR AVIATORS OPERATED BY AIR JETS

Training for the student flyer can be obtained in safety with an ingenious apparatus developed by a Seattle flying instructor. The student is seated in a "cockpit" with standard controls and a small model of an airplane is pivoted in the framework so that it can perform all the gyrations of a craft in full flight. Air jets, supplied by a motor and fan, are directed against the plane by operating the controls exactly as done when flying. Loops, dives, banks, rolls and other tricks can be performed as the student applies pressure to the rudder and moves the stick for these maneuvers, thus making him entirely familiar with the controls and the reaction of the plane before he makes his flight into the air.

Model of a Home of Aluminum and Glass; Structural Work Is Entirely of Metal and the Walls Are Composed of Aluminum Sheets

¶The earth is belted with more than 300,000 miles of submarine cables, over 100,000,000 miles of telephone wires, and with 5,000,000 miles of telegraph cables.

Tricks of the

A Cigar, a Book, a Tube of Toothpaste and a Bolt of Cloth Used as Receptacles for Smuggled Diamonds

DOWN the gangplank of a transatlantic liner shuffles a sailor with apparently no encumbrances but his clothes. A bulge in his sock above the ankle catches the eye of a watchful secret-service man, who takes the sailor into custody. A search reveals diamonds in each sock. Six packets of the precious stones are wrapped around one leg, and twenty-five around the other. When the seized gems are sold at auction the government realizes $90,000.

Such incidents are not uncommon on the New York waterfront, where secret-service agents are constantly matching their wits against clever and resourceful men—and women—who try to run the tariff barrier and the custom blockade. There is probably no other commodity that offers such temptation to smugglers as diamonds. The reason is simple. Unset stones worth $50,000 hardly make a bulge in an ordinary envelope; and yet, delivered safely in this country, they save the purchaser who evades duty about $10,000 and enable him to pay the smuggler a tidy sum for slipping them past the government agents.

Uncle Sam is waging an apparently uneven battle in this war on diamond smugglers. How great are the odds against the forces of the law may be gathered from the merest glance at the marine list of the port of New York. There are some 200 to 300 foreign ships in harbor most of the time, with crews ranging from fifteen to 1,500 men each. Any man on those vessels is conceivably a carrier of uncut stones, and the manner of concealing the contraband is relatively easy.

Arrayed against this multitude, the force of the special agents assigned to guard against diamond smuggling consists of a mere handful of men. Even with the aid of various jewelers' associations, the odds are still overwhelmingly against them. Yet the way of the diamond smuggler is not without pitfalls.

In fact, the professional smuggler must be a wizard to continue his game for any length of time, for he has to pit his wits against enemies just as clever as himself. Besides secret-service men and informers, the smuggler faces foes in his own ranks. In addition, accident always lies in wait for him. Indeed, it has been through unforeseen circumstances that the deepest-laid schemes have come to light.

Diamond Smugglers

Diamonds and equally expensive stones have been smuggled into this country in thousand-and-one innocent containers, such as hollow canes, toothpaste tubes, sponges, jars of preserves, cakes of soap, backs of brushes, cartridges, tins of food and milk, even ear trumpets and nursing bottles. Scarcely any objects are above suspicion. Hiding diamonds in shoes is an old trick. Years ago a Chicago man whose feet were aristocratically tiny made capital of them by wearing shoes several sizes too large with compartments in them for loose gems and mounted jewelry. His boots could hold forty-two chains, 112 diamonds and forty-three pearls in one trip. A steward noticed the discrepancy between his feet and their covering and made it a topic of conversation, with the result that the news reached the ears of a government agent. Disclosure followed.

Fountain Pens or the Head of a Cane Frequently Are Found to Be the Hiding Places for Gems

The trick was a new one when the Chicago man tried it, but, as years passed, it became one of the commonest smuggling methods known. Even so, it is tried again repeatedly. A year or so ago, the disproportionate feet of a ship's electrician led to the seizure of $100,000 worth of cut but unset diamonds, the arrest of several persons and the uncovering of the trail of an international diamond-smuggling syndicate that had Antwerp and New York as its main bases, and an annual turnover of between $40,000,000 and $50,000,000.

As stated, unforeseen circumstances sometimes are the means of upsetting the most carefully laid plans. One particular smuggler wore garters in which he could conceal rubies and pearls. One day the garters broke and betrayed him. His wife also came in for an examination at the hands of the government agents. It was discovered that she had turned her extreme thinness to account by wrapping hundreds of yards of expensive lace about her body.

For twenty-seven trips across the Atlantic a hunchback managed to carry his contraband successfully in an artificial hump made of porous plaster and cotton wadding, with a filling of rings, brooches, necklaces and other high-duty valuables. His downfall was simple. One of the inspectors jokingly asked him if he could rub his hump for luck and the "cripple"

Top, Examining Folds of Bellows of a Camera for Stones; Below, Gems Found in False Heel of Shoe

showed such consternation that an examination was ordered.

Due to accident, another professional smuggler came to grief. Apparently he was a devout, kindly clergyman, who carried his Bible in his hand most of the time. Entering port, his baggage was given the usual examination and his Bible taken at face value. Walking down the pier he tripped, fell and his "precious" book went flying. In the unexpected tumble a secret spring was released and a shower of diamonds scattered on the ground.

A clever ruse was that of two brothers in the gay '90's whose trick was duplicated within recent years by a man and his wife. One of the conspirators would engage a stateroom for a round-trip passage. Into a hole in the floor was passed a bag of diamonds, where it was left until the next sailing date. Then, when bidding farewell, the voyaging brother would pass to the other the concealed contraband, and as no suspicion is ordinarily attached to visitors of departing friends, the scheme worked like a charm, until, in the case of the brothers, they enacted their grief at parting once too often for the secret-service men to swallow. Now anyone who reserves the same stateroom for return passage is open to suspicion.

Because the custom men know most of the tricks, the professional smuggler must keep inventing new ways to deceive them. Sometimes a bold course is taken, as when the smuggler declares his boxes of cigars, pays duty on them willingly to divert suspicion, and thus protects the gems cunningly wrapped in the havanas.

Technique of this sort recalls the woman who posed as a society leader and as such made several crossings yearly, always bringing in a wardrobe of gowns, millinery and shoes, upon which the duty was paid without a murmur. But the woman had servants who traveled in second and third-class cabins and brought over a fortune in jewels for her each trip. When one of them told on her mistress, it was discovered that the alleged society matron carried on a good retail trade with her friends and acquaintances.

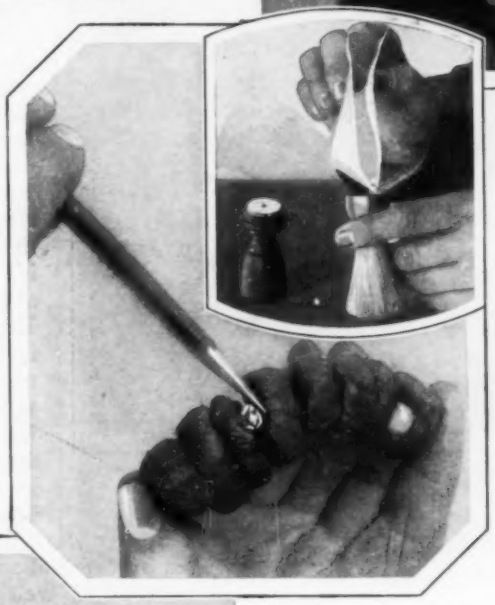
It has been authoritatively stated that amateur smugglers are responsible for as many contraband diamonds in the United States as are brought in by professional smugglers. This is not surprising if one stops to think of the vast number of tourists annually traveling back and forth between America and continental Europe.

These amateurs, however, as a general rule are not clever enough to avoid being caught by the experienced custom sleuths.

There is one factor that greatly aids the government agents in catching amateur crooks: Congress permits one-fourth of the value of the confiscated gems to be paid to any informer who "tips off" the government men.

As a result, "double-crossing" is often practiced in the jewelry shops of the continent, where gullible Americans are persuaded to buy jewels by the promise that the purchase will not be reported to the authorities—as the law demands; and the buyers are assured that their purchases can be conveyed past the customs without duty.

But the seller of the gems does not keep his promise. Instead, he immediately reports the sale to the revenue authorities. Then, when the returning American customer attempts to leave the dock without declaring the jewels, he is caught—and the informer collects both ways. But that is the case of the amateur smuggler. With the professional it is a far more difficult problem.



Exposing Diamonds Concealed in Bar of Soap, Shaving Brush, Twist of Tobacco and Hairbrush

"To discover all diamonds brought ashore," James McConnachie, for years in charge of the custom-division work in New York, has stated, "we would have to search every member of the crew and every passenger on every ship. We do seize diamonds and recover hundreds of thousands of dollars in duties annually, but these are chiefly from tourists who attempt to smuggle in finished jewelry. Not many of the so-called commercial carriers, the carriers of unset stones, are caught. We get results only when we get advance information as to the carrier—and not always then."

DOES NAIL DRIVEN IN A TREE MOVE AS TREE GROWS?

Accurate measurements have shown that a nail driven into a young tree does not move in the least, either upward or outward, as the tree grows. The point was raised recently when a claim for land revolved around a spike driven into a young tree as a surveyor's bench mark. Botanical experts showed that the nail would not move upward since all the tree's growth in this direction is from the top. It was also established that the nail is not pushed outward. Instead the tree grows around it, imbedding it in the wood and leaving it in the same position.

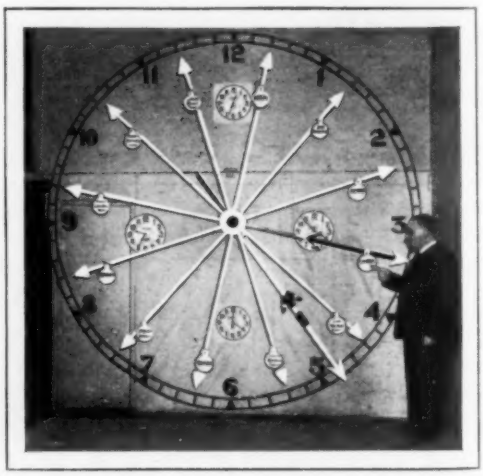
Crane Being Used to Hoist Model of Liner "Empress of Britain" to Second-Story Display Window; the Craft Weighs Half a Ton

HALF-TON SHIP MODEL LIFTED TO WINDOW BY CRANE

When a ship model was to be placed on exhibition in the second-floor window of a London department store recently, workmen found it necessary to employ the same methods as though a real vessel were being lifted. They used a crane to hoist the model to the required height because the vessel, even in model form, weighed half a ton. It is an exact copy of the Canadian Pacific liner "Empress of Britain," and is one of the largest model boats in the world.

WORLD CLOCK INDICATES TIME IN SCORE OF COUNTRIES

Showing on its face the time for all parts of the world, a big clock with more than a score of hands has been built by an Omaha watchmaker who used mostly parts salvaged from other clocks for its construction. In actual cash, the round-the-world clock cost only $15, but the builder spent two years of spare time at the job. The mechanism stands more than five feet high, the pendulum weighs seventy-five pounds, and each of the weights tips the scales at 100 pounds. Hour, second and minute hands show Omaha time on a five-foot dial marked on the front window of the jewelry store. From the window to a rear wall extends a half-inch iron rod which carries the power to a clockdial eleven feet in diameter marked on the wall. It is this latter dial that shows universal time. Huge hands, over five feet long, carry the names of cities or countries throughout the world, indicating the time in seconds, minutes and hours as compared with Omaha time, which is shown by a dark hand. There are four places on the globe where the time varies in minutes as well as hours from local time, and this made it necessary to build four smaller dials on the large one. The one second hand acts as a synchronizer to



Clock with Many Dials and Hands Which Indicate Time in All Parts of World Simultaneously

keep all the time in unison and the clock does not vary more than a few seconds in months. On the face is shown the time in Omaha, Denver, San Francisco, New York, Aden, Cuba, Bolivia, Argentina, Porto Rico, Paraguay, Brazil, Azores, Honolulu, Madeira islands, France, England, Spain, Austria, Germany, Bulgaria, Russia, Turkey, Sweden, India and Holland.

HIGH LIGHTHOUSE AUTOMATICALLY OPERATED

More than 700 feet above the Pacific ocean, on the tiny island of Lehua, among the Hawaiian islands, stands the highest lighthouse maintained by the United States. It is perched atop a high rock, very difficult to climb, and functions automatically, burning for a whole year without attention. Ordinarily lighthouses display their beams from points not more than 200 feet above the level of the sea, because otherwise they may be obscured by low clouds or fog. In Hawaii, however, fog is rare which made it practicable to erect the light at a great elevation. The light is visited once or twice a year by a tender who installs fresh tanks of gas.

BOTTLE DRIFTS TO PHILIPPINES FROM COAST OF MEXICO

Virtually spanning the Pacific ocean in eighteen months, a bottle cast adrift off the coast of Mexico was found recently near the Philippine islands. The bottle, containing a note giving latitude and longitude, was thrown overboard by an officer of an American steamer on August 11, 1929. When it was picked up last February it had drifted about 7,900 miles.

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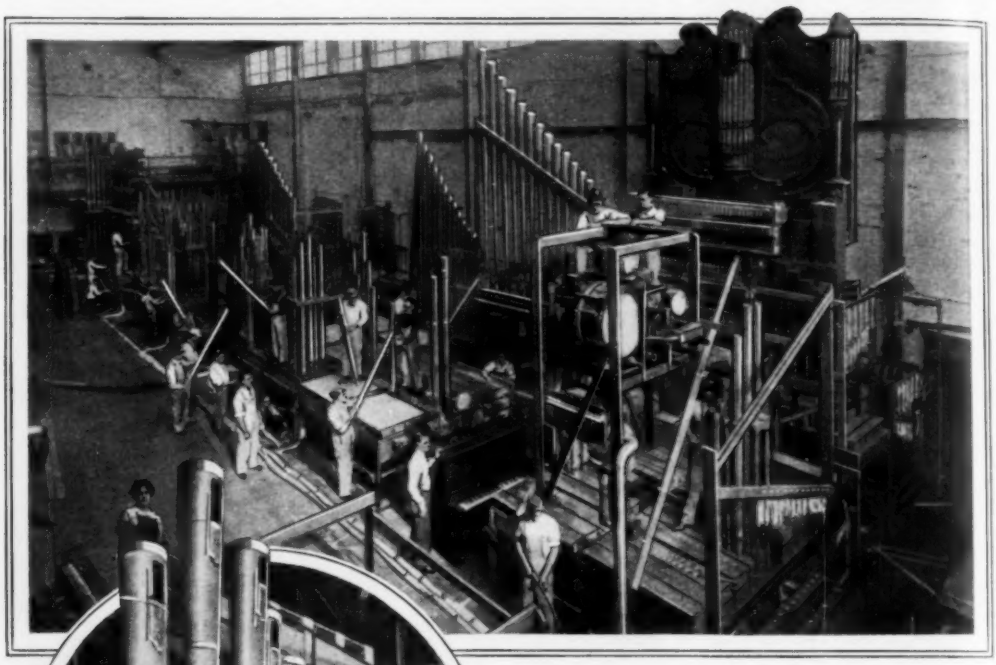
Portable Canvas Chute Which Is Quickly Set Up to Serve as a Fire Escape; It Is Intended for Institutions Housing Children

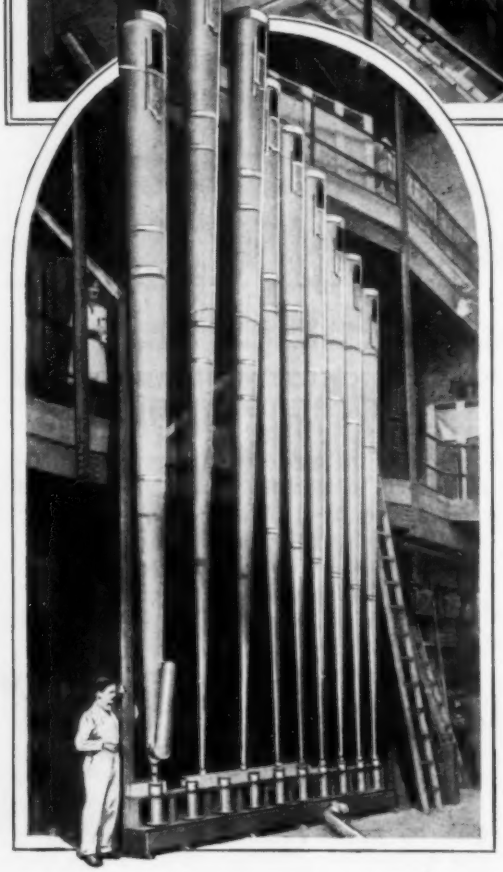
CANVAS CHUTE IS FIRE ESCAPE FOR CHILDREN'S HOME

As an inexpensive but efficient fire escape for children's homes and orphanages, the matron of one such British institution has invented a canvas chute. The chute is so made that it can be quickly put into position in case of a blaze, and the children placed in it to slide to the ground without injury. In a recent test, thirty children slid down the chute in less than two minutes. Where the safety device has been installed, part of the fire drill consists in training children to use the chute without fear.

¶Write our Bureau of Information, if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.

GIANT ORGAN CONTAINS EIGHT THOUSAND PIPES





Views Taken During Construction of Giant Organ Which Will Contain Eight Thousand Pipes

One of the world's largest musical instruments is the huge pipe organ being constructed for the municipal auditorium in Philadelphia. It has four manuals, more than 8,000 pipes, from half an inch to thirty-two feet in length, and producing from sixteen to 16,000 vibrations per second. More than 100,000 separate parts are contained in the organ and all electrical contacts are of sterling silver. The instrument has two consoles and can be played from two different locations in the building and an automatic feature enables it to be played without human aid. Every known percussion instrument is included in the assembly.

HUMAN LIFE TO BE HEALTHIER BUT MAY NOT BE LONGER

Present indications are that the span of human life, the actual number of years which an individual may attain, probably will not be lengthened much beyond its present limits, but it will be lived in much greater health and happiness than at present. This is the conclusion of Lee K. Frankel, insurance company official, who has made a close study of the possibili-

ties. There is no evidence at present to lead to a belief that human life can be prolonged greatly beyond its presumed biologic limits, he says, but adds that man's ability to adapt himself to his environment makes it impossible to predict definitely that he will not go farther along this line and push ahead his life span to some extent. Enough is known now to increase the number of people who can live to sixty years, the present average length of life, and even to push this age up another ten years. Future application of present scientific knowledge, however, will make the average man's life much healthier, he asserts, with the doctor laboring to prevent disease rather than cure it, and health habits being taught in schools along with the three "R's." Unnecessary disease, he believes, will disappear, and death in childhood will be rare.

ONE-MAN PORTABLE SAWMILL BUILT ON AUTO

Desiring a sawmill that he could move easily from job to job and could operate himself, a Portland, Ore., man built one on the chassis of his automobile. When not being used as a conveyance for the mill, a gear transforms the rear of the car

Portable Sawmill Built on Auto Chassis and Operated by the Engine of the Car

into a combination endless belt, saw and piler-up.

EYE OF ELECTRICAL DETECTIVE SPOTS COUNTERFEITS

Electric Detector Which Spots Counterfeit Certificates by Identifying the Paper Stock

Counterfeit stock certificates can be spotted quickly by the use of an electric detector developed in the Westinghouse research laboratories. The detector operates by determining the thickness of paper. Almost invariably imitation stock certificates are printed on a stock of paper slightly different from that used for genuine shares. A certificate of the latter class serves as a standard in setting the apparatus, which brands the imitations as false as soon as they are inserted in it. The same apparatus can be used to test grades of paper for magazines and it is also expected to be of value in distinguishing rare paintings from copies and imitations.

NONSKID MEMORANDUM PADS

Business men who attempt to take notes with one hand while holding a telephone with the other now can do the job easier with a nonskid memorandum pad that has recently made its appearance in England. It consists of paper clipped in a bar at the top of the pad with a flexible sheet of rubber at the back. The rubber clings to the desk surface and molds itself readily to "bumps" of papers that may be piled on the desk.

Interlocking Slabs of Metal and Glass Which Are Used as Inexpensive Building Material

INTERLOCKING SLABS OF GLASS AND METAL FOR BUILDINGS

Interlocking slabs of metal and glass compose the latest form of construction material for buildings. The designers of these slabs claim that three-inch insulated walls of metal and glass have a heat-retaining value equivalent to a brick wall three feet thick. The weight is only one-tenth that of a twelve-inch brick wall. The slabs come in four-by-six-feet squares and are ready for bolting together at the building site. The time for construction is about one-half that required for ordinary masonry, and the cost is about one-fifth less.

EAGLE HUNTING WITH PLANES

Airplanes are being used successfully in Texas to hunt eagles that prey on spring lambs. One rancher employed a pilot to kill the birds after other methods failed. The flyer located the eagles at an altitude of 5,000 feet above the ranch and a companion killed five of them with a shotgun as the plane flew alongside. This rancher estimated the birds caused him a loss of $2,000 a year by carrying away lambs.

¶Evidence that man had reached a well-developed stage of mining activity when mastodons trod the earth has been uncovered in South Africa.

GAS DETECTOR FOR AIRPLANES SHOWS CARBON MONOXIDE

Navy aircraft pilots are to be protected from the danger of carbon-monoxide-gas poisoning by an automatic recording instrument, extremely sensitive to this form of gas, in cockpits and cabins. The instrument is to be installed in the big navy dirigible "Akron," to check the operation of the heating system and to warn against leaking exhaust fumes in the engine room. A chemical mixture of manganese oxide and copper oxide, called hopcalite, actuates the apparatus by serving as a catalytic agent to accelerate the chemical reaction which changes carbon monoxide into carbon dioxide. The recorder involves an application of principles employed in gas indicators installed in the Holland tunnel but, since it is light and portable, it can be employed also in industrial plants, boats or other places where the atmosphere may be contaminated. Traces of carbon monoxide as low as two one-hundredths of one per cent are shown.

GIANT AMPLIFIER FOR TALKIES HAS PURITY AND VOLUME

Resembling an old-fashioned phonograph horn, greatly enlarged, a giant loud speaker is being used in Germany in the production of talking pictures. The amplifier, larger in diameter than a man's height, has great purity and volume. The well-constructed horn transfers the vibrations of the tiny diaphragm through four amplification stages to the larger unit.

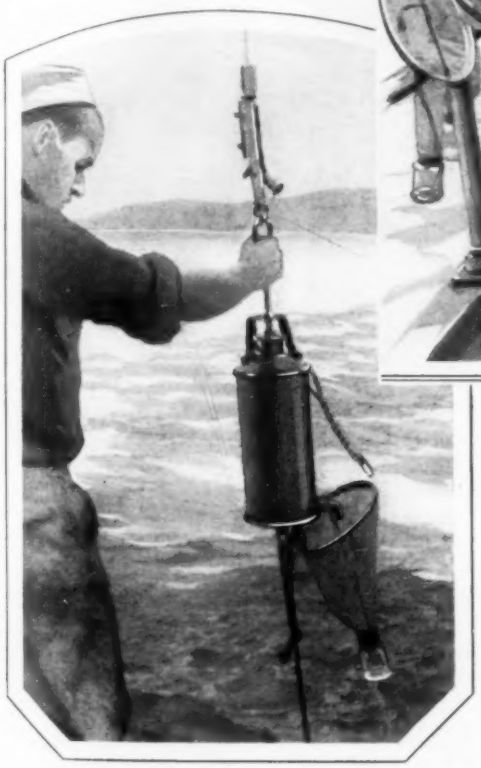
© Presse Photo

Huge Loud Speaker, Taller Than a Man, Used in Production of Talking Pictures in Germany

The Secrets of the Sea

By RALPH ANDREWS

WHENEVER you read in the papers of a "dead sea" within the Pacific, or of water in a large area of the Atlantic slowly sinking to the bottom and returning to the Antarctic, or of rivers in the ocean, or of denizens of the deep becoming lighter in color at night, don't think the reports come as the wild imagination of some fiction writer.

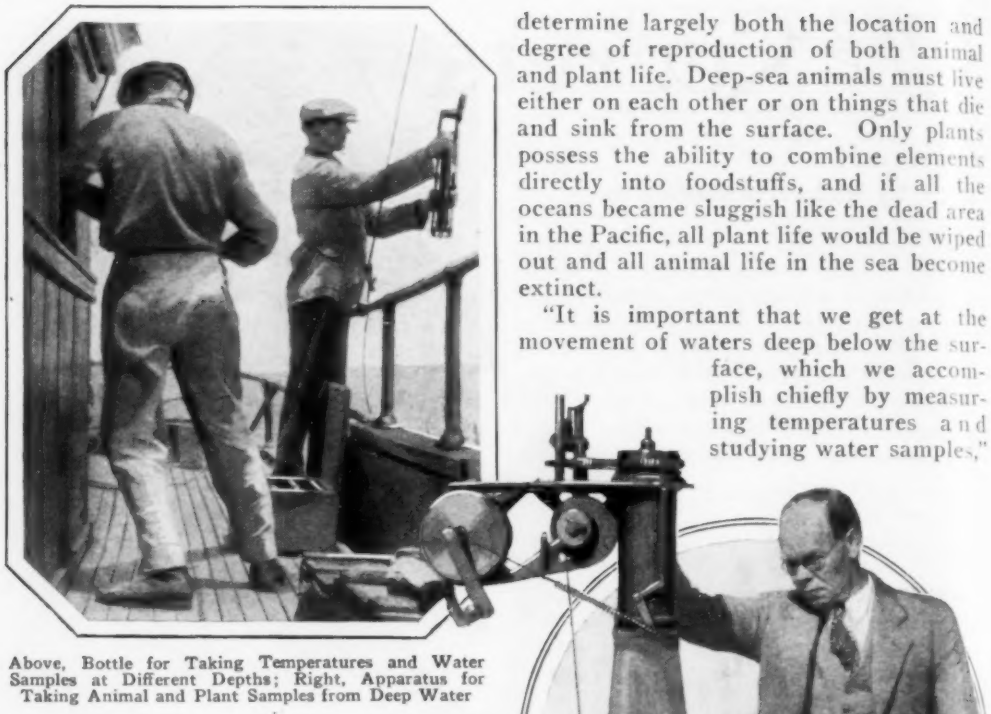


Above, Washing a Haul of Plant Life Taken from Pacific; Left, Using a Closing Bucket to Obtain Water and Its Animal and Plant Life from Depths

These facts represent years of research by scientists on such ships as the "Carnegie," which burned a few months ago in Australia. On her seventh and last cruise, this ship was sailing south toward the equator, outbound from San Francisco. Aboard her several scientists, including Dr. E. G. Moberg, were studying the oxygen content of the sea from the surface to depths nearly four miles below. As the ship moved southward she paused at intervals, and Doctor Moberg dropped over the side a wire nearly 20,000 feet long, with self-sealing steel bottles attached at intervals of 1,500 feet.

After the line had been payed out, he slipped a small brass "messenger" over the line and dropped it into the sea. As the messenger struck the top bottle, the bottle turned over, sealing itself; then another messenger rattled down the wire to another bottle, and so on until the last bottle, four miles below the vessel, had upended and sealed within itself a sample of water the scientists could study at their convenience.

But what did these water samples reveal? That an 800-mile strip extending downward in the Pacific from the 500-foot level to the 1,500-foot level, stretching



Above, Bottle for Taking Temperatures and Water Samples at Different Depths; Right, Apparatus for Taking Animal and Plant Samples from Deep Water

from South America westward to the region of the Samoan islands, is devoid of life. In it, for some strange reason, there is no oxygen, or so very little that no life can exist in it. Just why there should be no oxygen at those levels when a supply ample to support life was found both below and above the dead patch, the scientists can explain on no other ground than that the water there moves very little and does not come in contact with waters bearing oxygen down from the surface.

The Atlantic is "self-energizing" by means of the large sinking area, whose presence and action have been confirmed by recent expeditions. In the sinking area, heat evaporates the surface water which becomes heavier through an increased salt content. This water gradually sinks and, although slow in movement, becomes virtually a stream flowing into the Antarctic. At the same time two great streams from the Antarctic flow northward into the Atlantic, one along the bottom and the other about 3,000 feet below the surface. How are the locations and presence of these determined?

Science finds it important to know these things, since movements of ocean waters determine largely both the location and degree of reproduction of both animal and plant life. Deep-sea animals must live either on each other or on things that die and sink from the surface. Only plants possess the ability to combine elements directly into foodstuffs, and if all the oceans became sluggish like the dead area in the Pacific, all plant life would be wiped out and all animal life in the sea become extinct.

"It is important that we get at the movement of waters deep below the surface, which we accomplish chiefly by measuring temperatures and studying water samples," explained Dr. T. Wayland Vaughn, of the University of California. "By studying the water samples we determine the quantities of salts and express them in units of weight. Thus the saltiest part of the ocean contains approximately thirty-six pounds of salt in each 1,000 pounds of water. The density of sea water depends on its temperature, pressure and the salt content."

Oddly, the Atlantic is saltier than the Pacific. In the southeastern Pacific the water is saltier at a depth of 9,000 feet, and in the northwestern Pacific, at the same depth, it contains the least salt. In some

Pacific areas the water becomes saltier between the one and two-mile levels. On the average, the sea contains thirty-five and a half pounds of salt to each 1,000 pounds of water, yet it runs as low as thirty-two and as high as thirty-six and a half, increasing from the poles toward the equator, where evaporation is heaviest.

Not all the studies are concerned with the sea and its movements, however. Scientists are puzzled over the action of "blushing" fish. They want to know why all fish, excepting one species in the Nile that swims upside down, have light-colored stomachs and dark backs. They want to know what happens when fish change colors in changed environments. They are especially interested in animals, since plants do not exist generally below the 300-foot level, due to the absence of light. Animal life, on the other hand, thrives in the dark even in the deepest parts of the ocean.

In the laboratories of the Scripps Institution of Oceanography, Prof. Francis B. Sumner has set up a series of experiments, rearing tiny fish in white and black jars. Although his work is new, during the last three months he has observed the growth of fish from the same stock, one group developing a very dark, nearly black, color, the other becoming almost transparent.

Elsewhere in the same room he has a hundred tiny fish thriving in four bottles whose only light comes through the bottom, via a mirror set at an angle to reflect light from the lamps. Will these fish develop light backs? Will they reveal that light filtering through ocean water accounts for the universal dark upper and light lower bodies of fish?

"Fish react quickly to their environment and to color," explained Professor Sumner. "Largely fish colors are not permanent. Their colors change through eye impressions. Blind flounders, which, when they can see, take on patterns of the ocean floor, change little in new environments. Yet blind fish have turned darker in the light and lighter in the dark due to a stimulation of some part of the brain. Ocean fish bleach during the dark, and for this we have no explanation except that the eye impression effects the change."

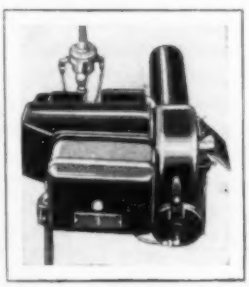
Pegs Set in Wooden Floaters Are the Targets for Rings in This Latest Form of Water Sport

BARNYARD GOLF IN THE WATER IN GAME OF RINGERS

Horseshoe pitching in modified form has taken to the water in the game of ringers. The players, in bathing suits, pitch large rings at pegs set in upright floaters, each of which is marked with a number to facilitate scoring. The bobbing pegs make difficult targets and considerable skill is necessary to throw a ringer.

AUTOMATIC OIL BURNER KEEPS AN EVEN TEMPERATURE

Requiring virtually no attention, an oil burner with automatic controls maintains an even heat at any temperature required. There are only two adjustments, one for air and one for oil. The air intake is regulated by screws on the side of the fan housing, and the oil flow by varying the pressure on the diaphragm valve. Once adjusted to give the most heat at lowest fuel consumption, the device needs no further attention. A thermostat provides automatic temperature control, and the device is equipped with electric ignition, making a gas pilot unnecessary.



Salon of Princess Victoria Louise in Historic Berlin Castle, Which Has Been Transformed into Classroom for Psychoanalytic Study

STUDY OF SCIENCE CONDUCTED IN OLD BERLIN CASTLE

Historic Berlin castle today serves mainly as a museum because its ornate halls and old furniture attract much attention, but several rooms have been placed at the disposal of German scientific institutions. Among them is the former salon of Princess Victoria Louise, which has been converted into a classroom for the psychoanalytical institute of Berlin university.

WEATHER DATA AID TO RAILROADS

Weather studies now are being made specially for the benefit of the railroads. Prof. Robert De Courcy Ward of Princeton university has been gathering data that may reduce the expense and increase the safety of rail traffic. His work is based on the belief that construction engineers should know, before starting to build, whether they will have to deal with deep snows, heavy rains, severe cold, floods, heat, droughts, dust and ice storms. Most if not all this information is available in the official meteorological summaries, and a study of the weather over a long period for any particular area shows what may be expected for the future and aids railway engineers in planning their lines to best meet any hostile weather likely to be encountered.

ACTIVITY OF FISH ON MANY DIETS IS TESTED

To determine the reaction of goldfish to certain foods, an apparatus has been made to record their activity under various conditions. In swimming about in their tank, the fish brush against a weir made of glass capillary tubing, the motion being transmitted to a pen which makes a record on a mov-

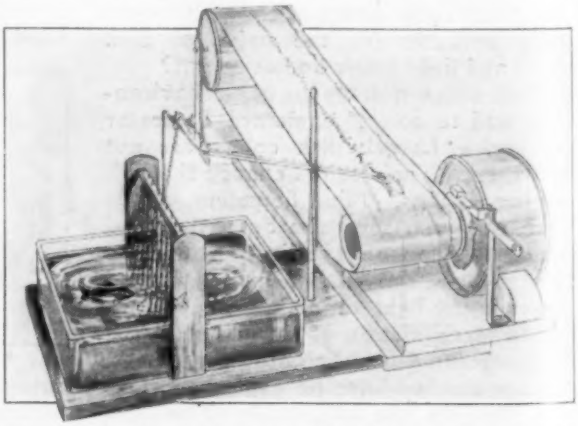
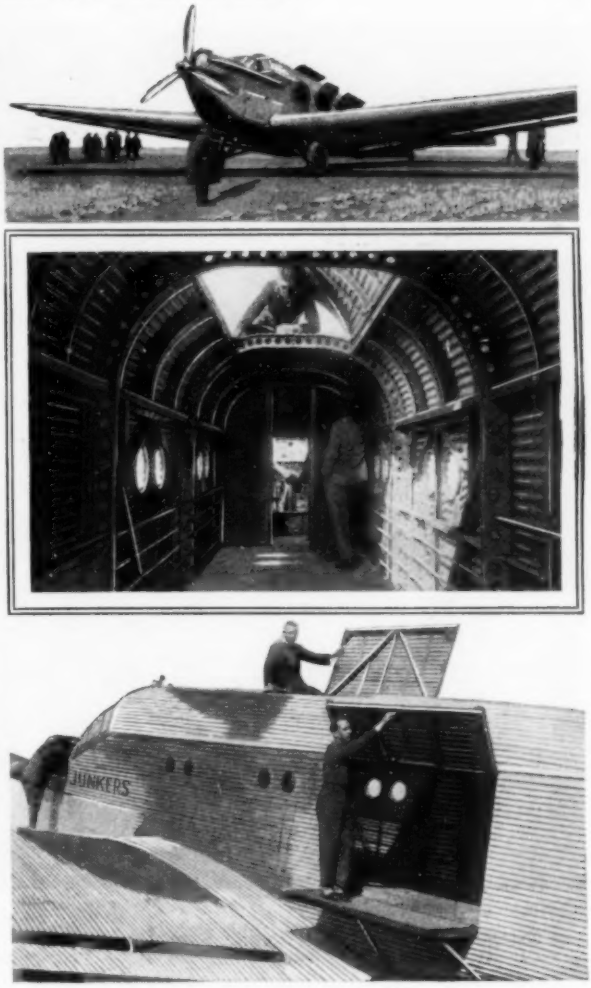


Diagram Showing the Apparatus Which Traces a Record of the Activity of Goldfish under Various Conditions

ing belt of glazed paper each time it is disturbed. It was found, for instance, that the fish increased their activity 400 per cent when fed a gland extract instead of the usual diet of dried shrimp meat.

EYE AND HAIR COLOR ARE RELATED TO ANGER AND FEAR

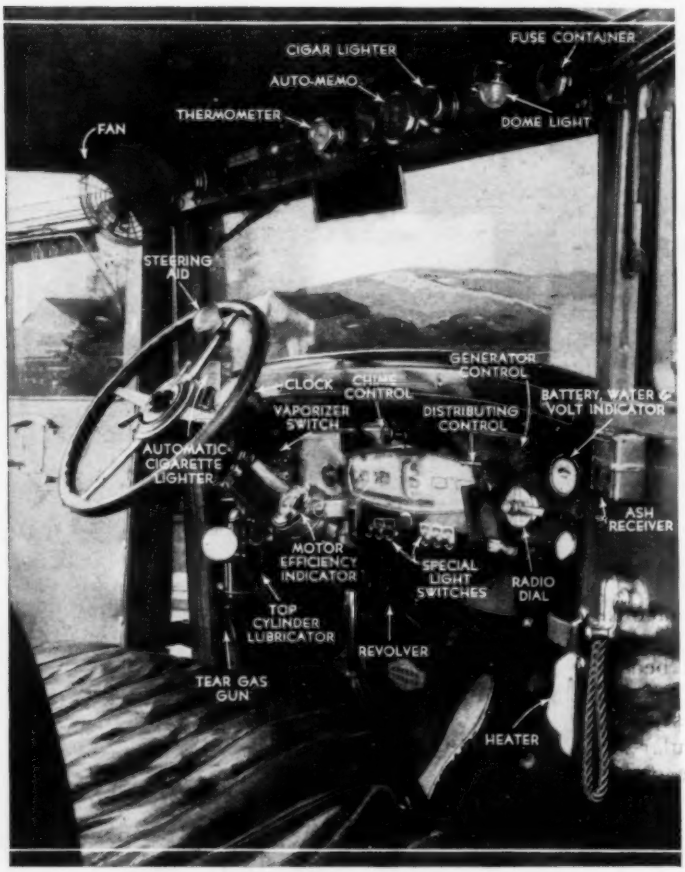
Physical differences in the color of eyes and hair and the shape of the head, which are usually associated with different races, have a relation to the extent to which persons get angry or become afraid. This is the conclusion reached by Dr. G. M. Stratton after a study of more than 1,000 students at the University of California, where he is professor of psychology. Measurements were made of the heads of these students, hair was classified as light, medium or dark, and the eyes were tabulated as pure-blue or gray, pure-brown or black, and intermediate or mixed. To find out how emotional the persons were, each was given a list of situations which might cause one to become irritated or frightened while not disturbing another. Typical situations were, "You hurry for a street car and miss it by a narrow margin"; "While telephoning you are cut off in the midst of a conversation"; "You find yourself looking down from a high place from which the drop is precipitous"; "You are awakened by sounds as though someone were moving in your room." The students made a record of the way they felt in the various circumstances. From this record Doctor Stratton decided dark-haired persons have more intense fear than medium-haired ones, and the latter are more intensely angry than the light-haired. Light-eyed persons were found to become more intensely angry than the medium-eyed. Narrow-headed persons are more intense both in their anger and fear than those whose heads are of medium proportions or are broad.



Interior and Exterior Views of an Airplane Furniture Van; It Has a Capacity of Three and One-Half Tons

AERIAL FURNITURE VAN HAS CAPACITY OF THREE TONS

German families who are in a hurry to move, now can have their household effects transported in a flying furniture van. A Junkers transport plane has been equipped like an ordinary moving van, with loading platforms on the sides corresponding to the tailgate of the big trucks. The inside of the body is nearly seven feet high and the ship has a capacity of about three and one-half tons. With this load it can fly more than fifty miles an hour and remain in the air for five hours, covering in that time about 262 miles in one test flight.



Courtesy Motor

Car Equipped with More Than Twenty Accessories to Increase Its Performance or Add to Driver's Comfort; Note the Tear-Gas Gun

TWENTY CAR ACCESSORIES ADD TO MOTORIST'S COMFORT

One motorist who is traveling almost constantly has made a hobby of installing in his car every available accessory to add to his comfort or the efficiency of the auto. Today he has more than a score of manufactured accessories that fill virtually every inch of the instrument panel, steering column and the space above the windshield. Among them are a fan, thermometer, cigar and cigaret lighters, clock, chime control, radio, heater, dome light, ash receiver, tear-gas gun, revolver and a number of instruments to improve or indicate engine performance.

¶ Slot machines in Berlin now offer twelve-cent umbrellas.

ELECTRIC SKIN TO HEAT ROOMS

To test a new theory of keeping warm, a room with a heating "skin" has been constructed in the Westinghouse research laboratories. The skin is a surface impregnated with electric heating elements. The individual scales or sections forming the skin imitate ordinary wall and ceiling materials and can, if necessary, be coated with them. The walls have a finish of specially covered overlapping boards, and the ceiling is of soft, ivory-tinted material. All the heat comes from the walls and ceiling and the entire surface may be warmed, or the heat can be switched on by sections. These walls do not glow like a grate, nor become hot to the touch like steam pipes, but radiate a mild temperature almost exactly equal to that of the human body, and feel barely warm to the touch. Ordinarily the comfort of a room depends on the heat of its air, but the special room is being tested with air quite cool to determine whether the heat radiated by the body in all directions can be used both for comfort and a possible saving in fuel bills. Radiated heat travels with the rapidity of light and cold walls absorb this heat. Whether the lesser absorption of mildly heated walls will produce a worth-while difference in physical comfort is one question the room is expected to answer.

SECRET WRITING ON POSTCARD

Messages on postcards can be kept as secret as closed letters by the use of inexpensive forms of invisible ink. A solution of chloride of cobalt can be used for this purpose, since it is illegible until warmed.

A weak solution of sulphate of iron can be employed. This becomes black when moistened with a solution of galls.

CHANGING OF TYPE ON TYPEWRITER IS MADE EASY

Thirty or more type faces can be used on a typewriter with electrical action equipped with a circular frame on which the various type styles can be clamped. The machine is manipulated in the conventional manner, the electrical device operating to give an even impression, and only a few seconds are required to change from one type face to another. Strictly speaking, the type does not strike the paper at all for the platen and roller supporting the paper move up to press against the type. Each style of type is contained on a semicircular disk. Two disks are clamped on the circular frame at one time, making two type faces available. Foreign languages also can be used in the same manner. When the typist strikes a key, the circular device supporting the type revolves until the proper letter is in position, then the paper and roller move up and strike against this letter, making an even impression each time.

Electric Typewriter with Circular Frame on Which Different Type Faces Can Be Mounted

Miniature Theater in Which Actions and Gestures of Doll Actors Are Synchronized with Phonograph Apparatus to Give Them Voices

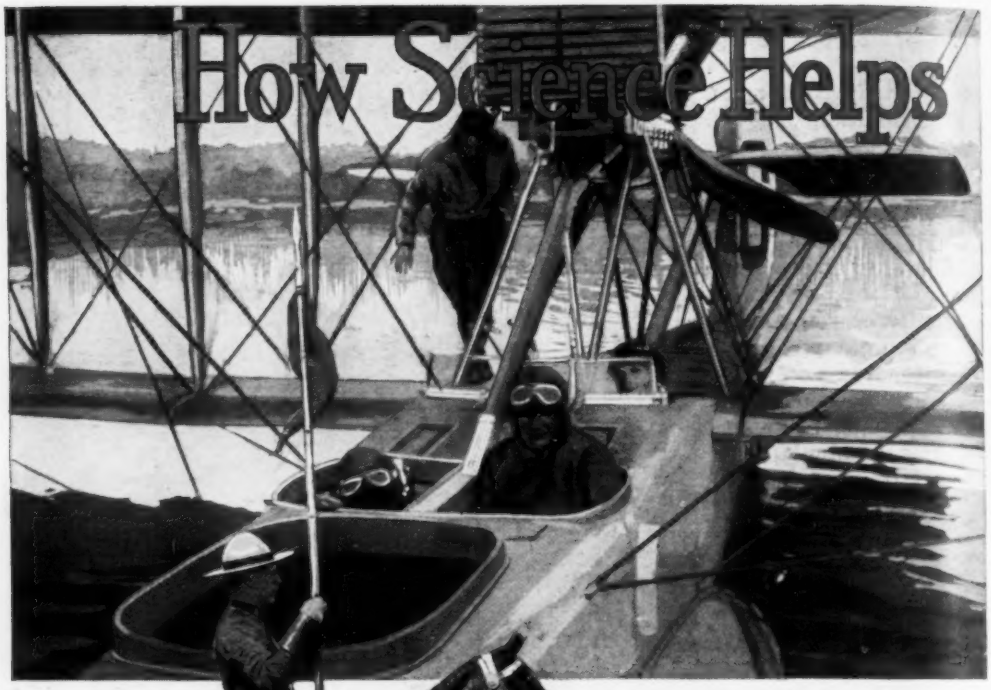
DOLLS THAT TALK ACT PARTS IN MINIATURE THEATER

Doll actors and actresses that speak their parts in human voices put on plays in a miniature theater in Hollywood, Calif. After several years of experimentation, the builder of this little theater succeeded in synchronizing the actions and gestures of the dolls with human voices by means of phonograph and radio apparatus. The theater is complete in every detail, even to revolving stages, and the auditorium seats fifty persons.

BURNING OF SODOM IS VERIFIED BY EXCAVATIONS

Biblical accounts of the fiery destruction of Sodom have been verified, in the opinion of scientists, by recent excavations in Transjordania. Dr. John Oliver La Gorce, vice-president of the National Geographic society, has announced that archæological discoveries made by a party of Jesuit priests directing excavations in this region have revealed that Sodom actually consisted of three different cities, built one upon another. The digging has revealed evidences of a conflagration of great intensity, penetrating so deeply that the stones of the first city, seventy-two feet beneath the surface, were scarred and seared by the fire.

How Science Helps



Above, Canadian Constable Taking Prisoner Out by Air from Lonely Trading Post; Below, Typical Officer and His Mount

By JAMES MONTAGNES

A MURDER is committed along the arctic shore. Two Eskimos had had a quarrel. A few months later a Royal Canadian Mounted Police constable on patrol hears about it from a trader, who was told by another Eskimo. Within a month, the constable has covered hundreds of miles with his fast dog team, and arrived at his post with the prisoner. On board a schooner, wintering near by, the radio transmitter starts sending out its dots and dashes. They reach a government station on the Hudson straits and are relayed to Ottawa, 2,400 miles away. Three days from the time the prisoner was brought in, Ottawa has sent instructions to the remote post at Cambridge bay. Compared with this, another murder in the same locality, before the days of radio, took five years of traveling back and forth before reaching the trial stage.

The famous Canadian police force is using every possible modern means to quicken its work. It was once a force in which every member had his horse. Today, of the 1,100 men who make up the Royal Canadian Mounted Police, less than 200 have horses. The other horses have been replaced by fast dogs in the far north, by automobiles and motorcycles in the settled parts of the dominion, by power schooners and motorboats in the eastern and western arctic, and even by

Canada's Mounted Police

Above, Mounted Police Taking Advantage of a Primitive Form of Travel; Below, an Officer and Three of the Dogs That Aid Canadian Police

plane, where that means of travel has been necessary.

A small trading post and a forest ranger's station in the hinterland of northern Ontario, several hundred miles north of the railway, is thrown into turmoil. Among the Indians who come to trade at the store is one huge fellow. He has been behaving strangely, his fellow tribesmen tell the storekeeper and the forestry men. Then one morning he goes amuck. His size and strength are with him, but eventually he is caught and locked up. But at the outpost they cannot take care of him. A message goes out from the small radio transmitter kept at the forestry station. It is picked up at the central station of the forestry service at Sioux Lookout, on the railway. Here it is put on the telegraph wire, direct to Ottawa. Two days later a government plane arrives from Ottawa with a Royal Canadian Mounted policeman. He takes the insane man out by air to a hospital. It would have taken him weeks to have made the trip by any other means.

The mounted police patrol vast territories and are to be found in nearly all the cities of the dominion. Once a frontier force on the prairies, they now make the vast northland their stamping ground. In the Yukon and the Northwest territories they have many posts. The northernmost detachment is that at Bache Peninsula, Ellesmereland, in the eastern arctic. It is the world's farthest north police

Above, a Group of Canadian Mounted Police; Below, an Officer Giving Road Information to a Party of Tourists

post, 770 miles south of the north pole. There is nothing frontierlike about the police posts in the north. Thousands of miles from civilization, the police live in frame homes as up to date as those in the suburbs of any city. The bitter winters of the region have been offset by making available in these remote posts every possible modern scientific means of construction. And in addition there is no longer loneliness there, for the strains of radio music from the four corners of the earth are received in the far north at every post. It is as customary to hear German, Japanese or Australian stations as American and Canadian. News events and special instructions come winging their way to these northern police.

Since open water lasts but a few months of the year in the arctic, where the police station about one-tenth of their force and carry on their most interesting work, dog teams remain the standard means of transportation. The force has not yet been supplied with airplanes, though the occasional patrol is made by plane when such means of travel is available. But planes being few and far between in the Northwest territories in winter, the dog team becomes the method of travel.

While the mounted policeman is becoming less and less a mounted officer, nevertheless every man joining the force undergoes a careful training in horsemanship. Each recruit is taught to ride, not only in formation, but also in musical rides and in sport. Games on horseback form a large part of the training at the recruit center at Regina. Care of his horse is also taught, even though many of the

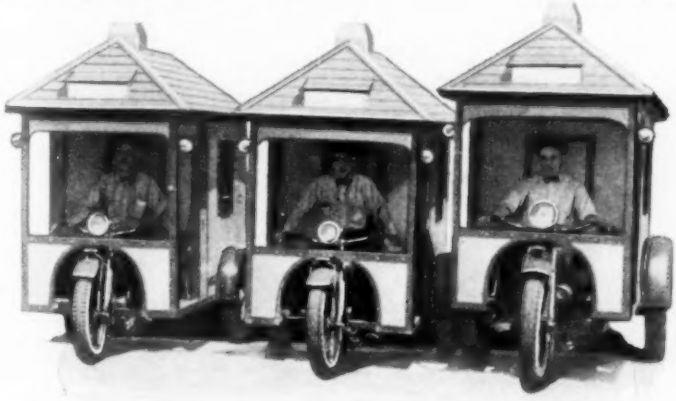
constables will have no horse to care for during much of their service.

The "Mountie" of today is liable to any one of many duties when he leaves the Regina training school. He has been taught how to conduct his court cases, horsemanship and the regulations of his work. But he may be sent as one of a detachment in the arctic, to a rural community or a mining camp in the northern limits of the provinces or to guard a building in Ottawa. But whatever his job and wherever he may be stationed, a member of the Royal Canadian Mounted Police is respected and obeyed as probably no other police officer in the world.

Preparing to Join Together the Halves of a Large Steamer After Vessel Had Broken in Two When It Went Aground in a Fog

TINY BUNGALOWS ON WHEELS CARRY HOME-REPAIR MEN

Motorcycles fitted with bodies resembling tiny bungalows bring home-repair men to residents of Los Angeles under a special service organized by one company there. Skilled workmen of all crafts and trades likely to be needed in making repairs about the house are included among the employes, and a telephone call brings the proper man to repair anything from the furnace to the radio.



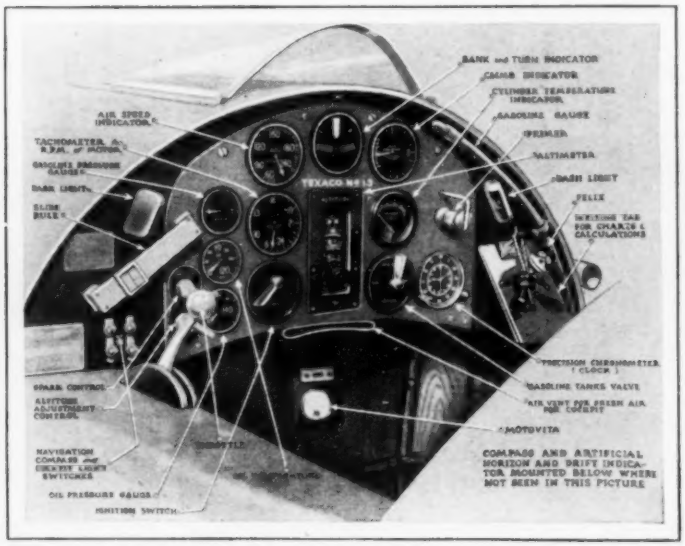
Home-Repair Service Men Answer Calls in These Bungalow Motorcycles

TWO HALVES OF SHIP SPLICED AFTER VESSEL BREAKS

Two halves of the 10,000-ton steamer "Nurtureton," the largest single-decker in the world, were recently joined together and the vessel placed back in service after it had gone aground and broken in half in a fog. The great length of the vessel made the break almost as clean as though the craft had been cut with a saw.

"HOT SPOTS" IN SOIL ARE CAUSE OF PIPE-LINE CORROSION

Instead of protecting pipe lines from corrosion by a uniform coating from end to end, the present tendency is to apply coatings selected with respect to the corrosive character of the soils involved. Corrosive areas, commonly termed "hot spots," are prevalent in many types of soils and it is in such areas that the lines suffer the most deterioration. The location of these hot spots is a matter of importance, both in the selection of coatings for new pipes and in repairing old.



Instrument Panel of Capt. Frank Hawks' Plane, Showing the Maze of Gauges and Controls; Note "Felix," Good-Luck Charm, at Right

MANY INSTRUMENTS AID PILOT OF HIGH-SPEED PLANE

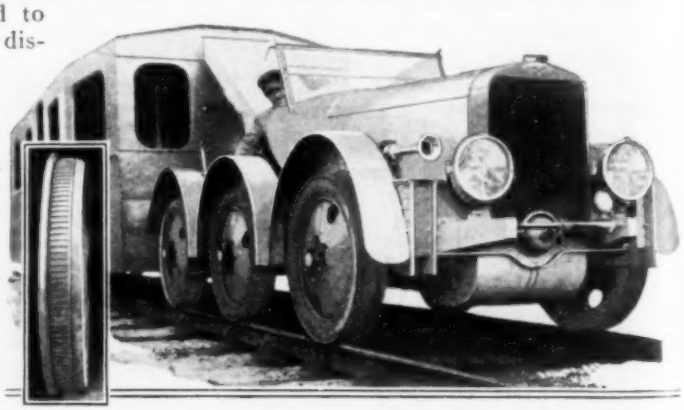
Pilots of high-speed airplanes have little time to loaf on the job because they are kept busy watching and checking the many gauges and instruments when the ship is in rapid flight. Capt. Frank Hawks' latest ship has more than a score of controls and instruments on the panel in addition to a good-luck charm.

CANCER CURE IS BEING SOUGHT THROUGH STUDY OF BLOOD

Cancer victims have blood more alkaline than normal, and the increased alkalinity seems to be related to the speed with which the disease terminates fatally. These facts were discovered recently by Dr. Ellice McDonald, director of cancer research at the University of Pennsylvania graduate school of medicine, and his associates who now are seeking a cure for the disease based on a study of the blood. X-ray and radium treatments, which may cure or at least retard cancer, have been found to affect the alkalinity of the blood also. These observations indicate that in the condition of the blood may be found a means of predicting the course of the disease and the success of treatment. Likewise a new method of treatment may be evolved which might turn out to be the long-sought specific cure for this malady, although the important point at present is that environmental conditions, outside the cell, influence the course of the disease. Cancer is a disease in which cell growth is abnormal and scientists long have been studying these cells to find what makes them grow "wild." It appears from Doctor McDonald's report that the reason for the erratic growth must be sought outside the cell.

RUBBER WHEELS ON RAIL CARS ABSORB SHOCK AND NOISE

One French railroad is experimenting with rubber wheels for its rolling stock as a means of providing greater comfort for passengers. The wheels have been used on a gasoline-driven engine and car for thirty passengers and have been found to stand wear well and to absorb shock and eliminate much of the noise.



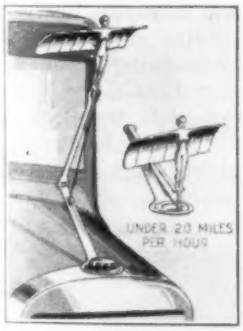
Gasoline-Driven Engine and Car Equipped with Rubber Wheels Which Have Been Found to Absorb Shock and Eliminate Much Noise

"SEA PASTURES" FURNISH FOOD FOR ALL KINDS OF OCEAN LIFE

Off the east coast of the United States are located the richest of all "sea pastures" in which the live stock of the ocean "graze." The coastal waters of North America are fertile for the same reason farm land is fertile—both are rich in nitrogen and phosphorus. Plankton, the tiny one-celled plants of the sea, feed on chemicals in the water just as wheat thrives on chemicals in the soil. Small sea creatures eat the plankton, larger fish eat the smaller, and so on up the scale. In the last analysis, all the fish in the sea depend on the tiny plants that can thrive only if the water is fertile, and scientists now are studying the sea's fertility as farmers study the same quality in the soil. Chemicals carried to the ocean by rivers, or arising from decay of organic matter, supply much of the richness of coastal waters.

DANCING FIGURE FOR RADIATOR RISES AS CAR SPEEDS

As a decoration for the automobile-radiator cap, a dancing figure now is being offered that rises as though flying when the speed of the car is increased. The figure, with outspread arms to which is attached a wing like that of a small airplane, is mounted on a hinged frame. When the car is motionless or moving slowly, the emblem stands poised on the cap. On reaching a moderate speed of about twenty miles an hour, the figure is forced upward by pressure of the wind on the wing and at higher speeds moves until it is in an almost vertical position. The decoration has only three moving parts and fits any type of cap.



Drawing Showing Electric Bait Catcher and Its Use in Driving Angleworms from Ground

WORMS DRIVEN FROM GROUND BY ELECTRIC BAIT CATCHER

Fishermen who like angleworms for bait but do not fancy the job of digging them or searching for them with a flashlight after a rain, now can catch the wrigglers by electricity. An electric worm expeller that forces the fishing worms from the ground is being offered for use on an alternating current or on current from an automobile battery. The expeller is inserted in a power supply and a rod is pushed in the ground. The worms, if there, will emerge within a few seconds.

SAFETY WEDGE FOR HAMMER KEEPS HANDLE TIGHT

Hammer heads and other tools are held securely to their handles by steel safety wedges now being manufactured in Germany. The wedge has three prongs, the outer ones beveled in one direction and the middle one in the opposite direction. When driven into the wood, these prongs enter in a diverging manner, expanding the handle and at the same time fixing the wedge firmly in place.

Chair with Seat and Back of Tubular Springs Resembling Those Used to Close Screen Doors

TUBULAR SPRINGS FORM SEATS AND BACKS OF CHAIRS

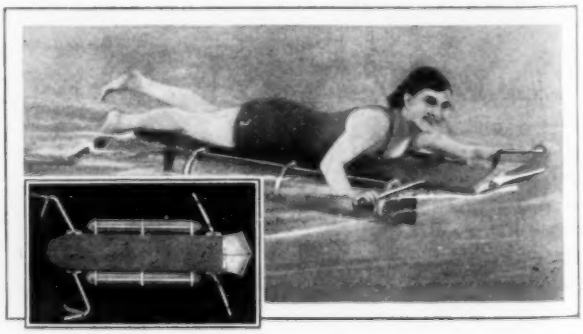
Chairs with seats and backs, formed by tubular springs something like those used to close screen doors, are being produced in Sweden. Such chairs provide extra comfort since the flexible springs conform to the contours of the body.

ELECTRIC "BRAIN" WILL SOLVE MATHEMATICAL PROBLEMS

Construction of a machine which will utilize electricity and light to solve mathematical problems that otherwise might require billions of years to complete, has been started at the University of California. The purpose of this electric "brain" will be to aid in the determination of factors of large numbers greater than two billion, and in other mathematical calculations. It consists of a shaft on which thirty gears of 100 teeth each are set. Meshing with the gears are thirty other gears with a varying number of teeth. Under each tooth in the second series is a small hole, and when the machine is ready for use, some of the holes are plugged and others are open. A beam of light is cast on the side of the apparatus and then it is set in motion by means of an electric motor. The main-shaft gears all revolve at the same speed, but the gears meshing with them vary in speed because of the different numbers of teeth. When, in the course of perhaps hundreds of thousands of revolutions, one hole in each wheel reaches the same point at the same time —when the thirty holes are lined up—the beam of light goes straight through the machine, strikes a sensitive photo-electric plate and stops it. A little counter which records revolutions made by the main shaft supplies a number from which the factors of the large figure under analysis can readily be obtained.

SWIMMING CRAFT LIKE A FROG ADDS SAFETY TO SPORT

Shaped like a giant frog, a swimming machine that will not overturn easily adds extra safety for the beginner to this form of sport. It is supported by two inflated rubber tubes, one attached to each side of a frame on which the swimmer lies face downward. It is propelled by two aluminum feet which are operated by hand levers in a natural swimming stroke. The feet close as they are brought forward and open on the back stroke. The arms operate independently, enabling the swimmer to turn in any direction. The large air tubes prevent the craft from overturning, even in rough water, and the device also can be employed as a life-saver for the private boat owner.



Swimming Machine That Looks Like a Huge Frog

A Super-Safe Aircraft

By THOMAS A. EDISON LAKE

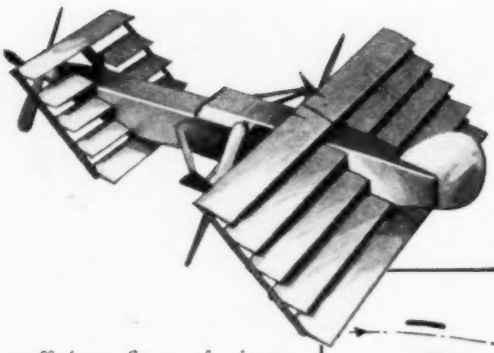
AVIATION will come into its own as an everyday means of transportation when a flying machine is produced that is able to rise from the ground in a vertical path, hover over a certain spot, travel horizontally at any speed and then descend slowly in a vertical path to a cushioned landing.

After more than twenty years of research, tests of model planes I have produced, and which are fully covered by patents, have convinced me that such a supersafety plane can be made. These tests substantiate the claims which I make for my type of machine, and I believe that in my full-sized, multi-wing aircraft, which I shall soon have under construction, the would-be flyer will find a vehicle in which he can take flight from, and alight in, his own back yard, the top of a building, or from any fair-sized vacant lot.

The usual type of airplane derives its lift from the reaction of the air through which it is being propelled against its inclined or cambered wings. The helicopter derives its lift from the direct vertical thrust of its propellers. Each type has its weaknesses. The usual airplane cannot make a vertical ascent or descent, while a helicopter would not be able to obtain any considerable forward speed without a direct loss in its lift, nor, in case of engine failure, could it make a landing without crashing.

Although my new machine is not a helicopter, it has the ability to ascend and descend in a vertical path. In addition, it has all the ability of the usual type airplane to make a gradual and safe glide to the ground in case of engine failure, and to make high speed in horizontal flight. The fundamental principle involved is that of "controlled directional air flow."

Since it is the relative speed between the airplane and the supporting air, irrespective of the actual forward motion of the machine relative to the ground, that gives the lift to the supporting wings, it stands to reason that if we can cause a



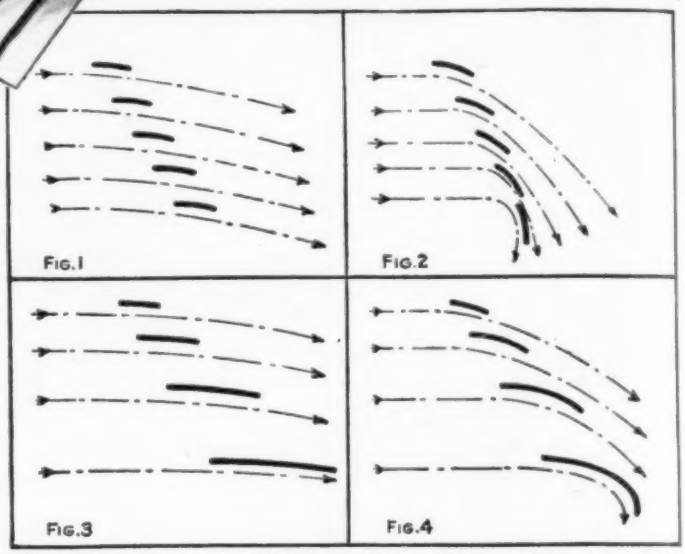
sufficient flow of air to the wings without forward pull or motion of the machine as a whole, we will obtain direct lift and vertical ascent.

To get sufficient flow of air to lift my new machine from the ground, three propellers, specially designed to give a spread of air, are set in front of three groups of staggered wings. Each bank of wings is capable of adjustment independently or in combination with either or both of the other two banks.

The forward group of wings, in addition to supporting its share of the total weight of the machine, acts in the capacity of the usual horizontal rudders for maintaining fore and aft trim. The two rear groups of wings each support their share of weight and, in addition, can be adjusted during flight for maintaining lateral stability and trim. The forward and rear vertical rudders provide means for steering under headway and turning when hovering.

The arrangement of the three groups of wings provides three-point support. The single group, being in front, does not blanket or interfere with the flow of air to the two rear groups. This arrangement also permits the machine to land or take off at a greater angle of incidence than is possible with the present types of machines having their horizontal rudders in the stern.

The groups of wings are so proportioned that all their supporting area is within the flow of air from the propellers. The individual wings are staggered, or arranged in steplike order, and are adjustable independently as to their angles of incidence. In normal position, for maximum high-speed flight, the wings would be adjusted practically parallel to each other, but for all other conditions of flight, the wings are adjusted with the angles of incidence progressively greater, beginning at the top wing and extending downward to the lowest wing of each group.



Top, Wing Area of Direct-Lift Plane Which Intercepts Flow of Air from Propellers; Diagrams Show Air Flow When Wings Are Set for Horizontal Flight or Maximum Lift; Last Two Figures Indicate Use of Flexible Wings Instead of Those of Fixed Camber

It is this steplike arrangement and progressive change in angle of the wings in each group that gives the high lift value for vertical ascent and, at the same time, offsets the forward pull of the machine as a whole. This lift value is greater per square foot of supporting surface than can be attained with any form of single wing. Each preceding wing in the group straightens out the flow of air over the top of the following wing, and the bottom and last wing of each group can actually be set at an angle prohibitive for any single-wing setting.

The extreme adjustment of the wing groups provides maximum lift without forward motion. A slight reduction from the extreme setting permits slow forward motion at maximum lift value.

LIGHTNING ROD "KNOCKS OUT" GIANT BOLT

Intended for use on high-power transmission lines, a lightning rod with a knock-out punch was tested recently in the Westinghouse laboratories. From a giant "spark plug" engineers shot at the lightning protector a total of 132,000,000 volt-amperes—enough electricity to lift the Woolworth building off its foundations. The lightning rod, a hollow tube about the size of a lady's umbrella, "knocked out" the bolt in a fraction of a second.

WHARF THAT GOES OUT TO SEA SERVES AS FERRYBOAT

Scurrying through the surf like a man-made water bug, a wharf that goes out to sea to meet boats is in use at Redondo Beach, Calif. This ferryboat, which acts as its own pier, is used to carry passengers out to a conveyor boat for a fishing barge some distance from shore. The craft is known as a sea tractor and was designed when the town's only adequate boat landing was destroyed. It is a float made of water-tight compartments, on which is an engine room and pilothouse and accommodations for twenty-five passengers. The engine works on a winch about which is coiled a chain, one end of which is moored on the beach and the other about 100 yards from shore. When the winch turns, the ferry pier moves along the chain to the waiting conveyor boat or back to shore. The shoreward end acts as a landing pier, being fitted with large rollers to prevent its jamming in the sand.

Wharf That Serves as a Ferryboat and Moves into Water to Meet Other Vessels; Note the Pier with Rollers That Travel in Sand

Dental Student Treating Tooth in the Head of a Manikin on Which Beginners Are Practicing

MANIKIN HEADS ARE "PATIENTS" OF DENTAL STUDENTS

Dental students of one eastern school are getting their practice in treating teeth in the heads of manikins. The heads are duplicates of the human head, each being supplied with a full set of teeth, a rubber tongue and various other substances to represent the conditions found in the human mouth.

"YELLOWING" OF PAPER CAUSED BY ROSIN

Strong corroboration of the theory that light-sensitive rosin is a cause of the "yellowing" of the better grades of paper, has been obtained as the result of an investigation of the effect of light upon rosin and rosin sizes by the bureau of standards. Certain samples of rosin and rosin compounds used in sizing paper were exposed in quartz tubes to the action of the rays of a carbon arc, and darkened in color under this treatment. Librarians and others are interested in the study, which indicates that exposure of records to light should be avoided as far as possible.

WORDS THROWN ON CLOUDS BY BIG SEARCHLIGHT

© Keystone View Co.

Powerful Searchlight Mounted on a Truck Which Is Used to Project Words onto Clouds; Letters 1,200 Feet Long Can Be Thrown on Them at a Height of About 6,500 Feet

Cloud writing is the latest form of advertising to be attempted in Berlin. The cloud writer is a large searchlight of 1,500,000,000 candlepower which projects the words onto the clouds. The light can project letters about 1,200 feet long to a height of 6,500 feet. The searchlight and its power plant are mounted on a truck, so the apparatus can be moved about.

COMPRESSION WOOD IN TREES RESULT OF HURRICANES

For years foresters have sought an explanation of the occurrence of compression wood in vertically growing evergreen trees, and the Florida hurricane of 1926 appears to have aided in solving the mystery. Compression wood is an abnormal type that is found more or less in all coniferous trees, the most outstanding feature of which is its excessive longitudinal shrinkage, from three to thirty-five times that of normal wood. This frequently is responsible for bowing, splitting and twisting of soft-wood lumber. It is readily distinguishable from normal wood by its relatively wide annual growth rings and its "lifeless" appearance. Commonly, it occurs on the lower, or compression side, of branches and leaning trees, but occasionally it has been found in vertically growing trees, growing first on one side and then on another but

forming only one part of any one annual ring. This has puzzled foresters, but recently fifty long-leaf pines from western Florida were examined, and it was found that compression wood had formed abruptly in the 1926 rings, indicating the trees had been bent during the growing season that year. They were in the path of the 1926 hurricane and it was determined that the compression wood had been formed during the part of the growing season when the hurricane struck. All the trees which formed compression wood in 1926 continued to form it the next year, but in 1928 it had diminished or ceased. This has led many foresters to conclude that high winds may be responsible for compression wood in trees which do not lean at the time they are cut.

"SPIDER'S PARLOR" ON CHIMNEY PROTECTS HUMAN "FLY"

Spiders' webs usually are considered a menace to flies, but a man-made web protects a human "fly" as he scales a 220-foot chimney in Pittsburgh. Workmen must climb this chimney frequently to make inspections, ascending a ladder formed of steps set into the bricks. The spider's web is an iron framework about the ladder to keep the climber from being blown off by a strong wind. A view looking up from the bottom of the chimney bears a remarkable resemblance to the "parlor" into which the fly is invited by the spider in search of a meal.

Looking up the Side of a Tall Chimney; Metal "Spiderweb" Protects Workmen on Ladder

MIRRORS HELP YOU IN TAKING A PICTURE OF YOURSELF

Subject Posing for Self-Portrait with Aid of Mirrors Which Reduce Image to Picture Size

Permitting a subject to pose and take his own picture in solitude, with due regard for pet vanities and without the distraction of a photographer, a camera and a set of mirrors have been combined in the making of fine portraits. By an arrangement of the mirrors, the person posing sees himself in front view or profile, the image appearing in the exact size of the finished portrait. The subject poses, presses a button and the view is recorded.

MERCURY MOVED WITH NEEDLE

Mercury can be attracted or repelled with the point of a needle in a simple experiment that at first appears like a mystifying phenomenon. A small quantity of mercury is placed in a saucer and some water, slightly acidulated with sulphuric acid and colored with potassium bichromate, is poured over it. When the mercury is touched with a needle, it first contracts and draws away from the point, then returns to the original position, continuing the process indefinitely. The action is due to alternate oxidation and deoxidation whereby the capillary state of the mercury is changed.

ROBOT THAT ANSWERS PHONE TAKES MESSAGES

Robot That Delivers and Receives Phone Messages When Subscriber Is Absent

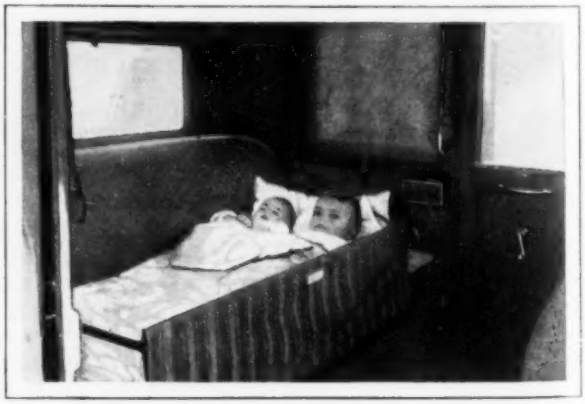
Receiving and answering telephone messages is accomplished automatically by a robot that tends the phone when the subscriber is absent. The machine operates by means of phonograph-reproducing cylinders, and is set in motion as soon as the bell rings. It lifts the hook from the receiver and informs the person calling that the subscriber is absent, or delivers any other message previously dictated, such as the time of return. A physician, for instance, can leave a number at which he can be reached. After delivering its message, the robot is ready to take a message and begins recording as soon as the person calling starts to speak. The apparatus also can be operated as a burglar alarm by means of sensitive wires which, if disturbed, will start the machine in operation and relay a message to the police.

NEW ESSENTIAL TO LIFE IN MILK PROTEIN

Although its exact identity still is hidden, a new essential to life has been discovered within the protein of milk. The latest food factor was announced by Dr. W. C. Rose, of the University of Illinois, after extensive feeding experiments upon white rats. The protein portions of the food given these animals were replaced by highly purified amino acids, the chemical building blocks out of which nature constructs the necessary proteins in food. All the twenty known amino acids were used in the diets on the theory that, if these compounds were all that makes the proteins of natural food satisfactory for growth and maintenance, the rats should thrive. Instead, they declined until small amounts of casein from milk, gliadin from wheat and gelatin from meat were added to the diet. The casein helped the rats to grow and, by chemical processes, this was split into pieces until finally a fraction was found that caused the animals to grow normally when just five per cent was added to the purified acid meals. This fraction is obtained from the casein by a form of extraction.

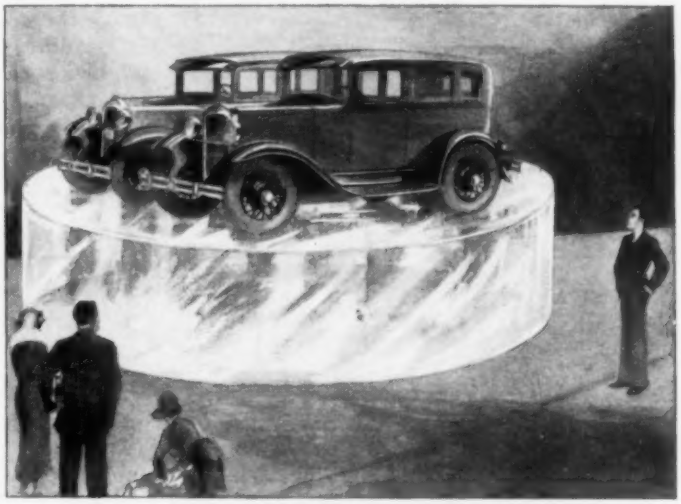
AUTO BED FOR BABY UTILIZES REAR-SEAT CUSHION

When a mother goes motoring, she can now take the baby with her in comfort by using an attachment which converts the rear seat of the car into a crib. The baby bed consists of a steel framework covered with upholstery to match that of the car and fits against the seat cushions. Two snap sockets hold the frame to the floor, and two straps lead from the top of the bed to concealed screweyes in the corners of the car. The bed can be placed in position or removed in a few minutes.



Heavy Cloth over a Metal Framework Which Converts the Rear Seat into a Crib for the Baby

"FROZEN EYE" TO BRING NEW WORLDS INTO VIEW



Huge "Frozen Eye" of Fused Quartz Which Will Become Reflector for Giant Telescope; the Two Autos Emphasize Its Magnitude

Hot, searing "sleet," somewhat like a winter's storm in reverse, has rained down steadily for months in a fiery furnace, and the largest mass of fused quartz ever produced on earth has thus been brought into existence. The disk is five feet in diameter, a foot thick, weighs 4,000 pounds, and was made at the West Lynn, Mass., laboratory of the General Electric company. Because of imperfections incident to the experimental nature of the work, the mass in itself is not satisfactory for finishing into a mirror, but the experiment of making it has resulted in the perfection of the process. The laboratory staff now knows how to produce large masses of quartz and make them perfect, which augurs success for the huge slab to be used in the 200-inch astronomical mirror for the largest telescope man has ever attempted to fashion—that provided for by the California Institute of Technology. A year ago these pioneers in a new craft melted a disk of quartz twenty-two inches in diameter. Then they sprayed its face with powdered quartz which rained down in the billowy flame of an oxyhydrogen burner—the "high-temperature sleet storm"—and deposited on the disk a surface glasslike in appearance. After several months the disk grew to sixty-six inches in diameter, layer after layer flowing from the burner in a stream to be melted by the intense heat, and then "freezing" solid before going through weeks of careful annealing. Now another five-foot disk has been started which, it is hoped, will be perfect. Then work will begin on the 200-inch reflector. The making of the great "frozen eye" will present the anomaly of freezing a substance in a furnace with a temperature of 4,000 degrees Fahrenheit. When plans were discussed for using quartz, with a melting point of 3,800 degrees, the task of pouring tons of this molten substance into a perfect job presented insurmountable obstacles. So, instead an experiment was started by making a small disk of quartz, placing it in the center of a specially constructed furnace supporting a continuous temperature of 1,800 degrees, then blowing powdered quartz over a burner at a temperature of more than 4,000 degrees. The powder was turned to molten quartz and blown forward to the small disk where it was literally frozen on this nucleus with its comparative coldness of 1,800 degrees. Thus the sixty-six-inch mass was formed. The 100-inch reflector for the Mount Wilson observatory is made of fused glass weighing two tons, which was melted into a solid chunk in a furnace. It took more than a year to cool that piece of glass without cracking it. If glass had been chosen for the 200-inch reflector, it is estimated the cooling time would have been over six years with an additional four years necessary for polishing. The Mount Wilson telescope has brought to view one thousand million stars, the light from the farthest of them having taken over 150,000,000 years to reach this earth. The frozen eye, with its diameter of nearly eighteen feet, is expected to see four times as far and astronomers have estimated that it will bring into view ten times as many stars.

Rotor Type of Windmill Which Maintains a Supply of Fresh Water for a Long Island Duck Pond

WINDMILL OF THE ROTOR TYPE PROVIDES WATER SUPPLY

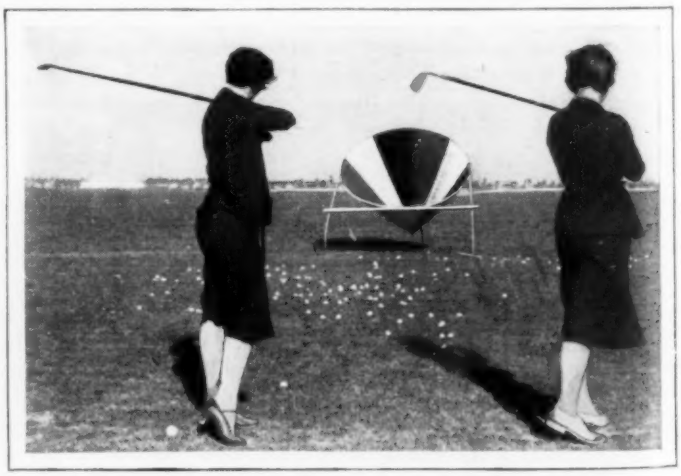
Although they have been used in Europe for several years, windmills of the rotor type only recently have been tried in this country. One is located on a Long Island estate where it maintains the water supply for a duck pond. Instead of the usual blades, the mill has at its top an apparatus shaped somewhat like a cylinder with one side exposed.

BLIND READ PLAIN PRINT BY AID OF METAL ROLL

Blind persons may soon have opened to them the entire field of ink-printed books through the recent invention of the printing "visagraph," a machine which duplicates on a roll of aluminum foil in enlarged and raised characters the type of a printed page. The type on the roll can be read as easily as the characters printed in Braille, which does not resemble the ordinary alphabet and to which the reading of blind persons has been confined heretofore. The visagraph looks like a flat desk with a box on top. The book to be read is placed in the left side of the box, opened at the desired page, which is pressed against a plate of glass. Above are a lamp and a selenium cell, the latter sensitive to light. In the right side of the box is the transmitting apparatus which receives the impressions from the cell and prints them on wide sheets of aluminum. The impressions on the metal roll may be preserved, or erased by passing the aluminum through rollers like a clothes wringer, after which it can be used again. The rolls resemble in size and shape those used in a player piano.

VARIATION OF GOLF IS OFFERED IN PITCH-SHOT GAME

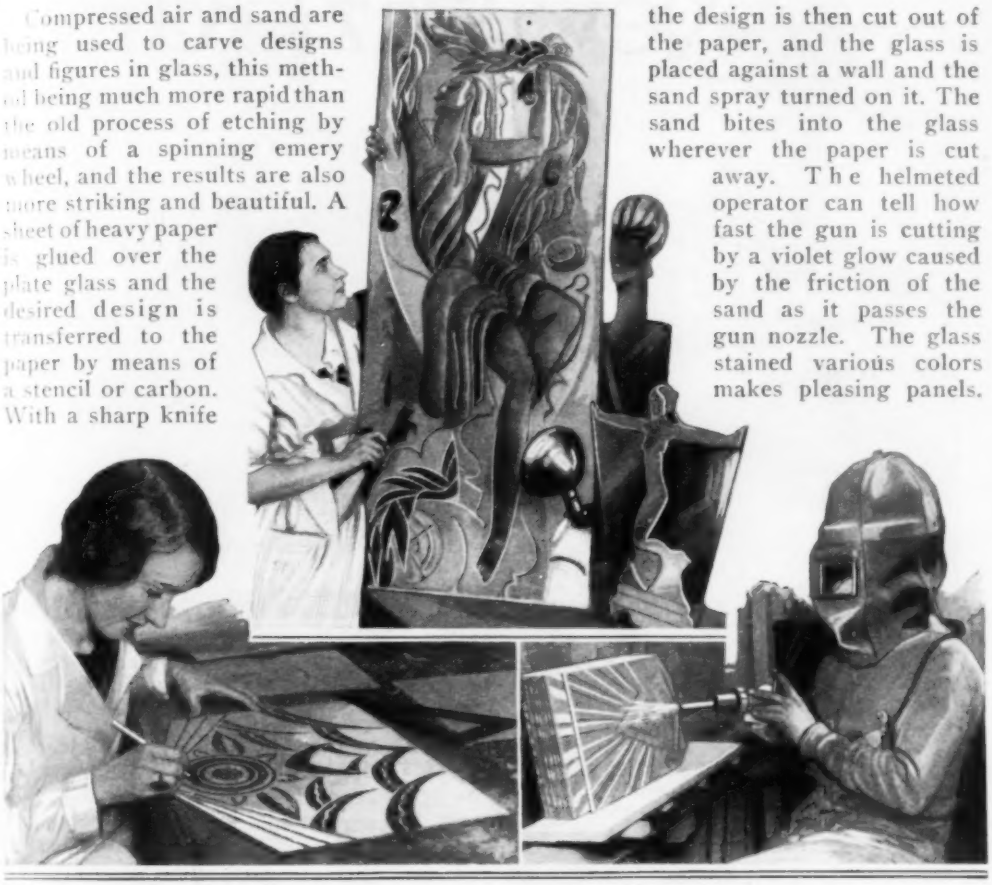
Pitch-shot golf is the latest variation of this sport to win favor on the Pacific coast, and is intended particularly to provide a method for practicing chip shots. Gaily colored canvas cones, placed at varying distances from the tee, form targets into which a well-placed shot will send the ball. Starting on the near-by targets, which give low scores, the increasingly skillful player graduates to those farther from the tee, which count higher. Balls of different color are used.



Here Is the Latest Way to Become Proficient with Your Chip Shots; the Large Canvas Cones Form the Targets for the Balls

GLASS CARVED BY SAND IS STAINED WITH COLORS

Compressed air and sand are being used to carve designs and figures in glass, this method being much more rapid than the old process of etching by means of a spinning emery wheel, and the results are also more striking and beautiful. A sheet of heavy paper is glued over the plate glass and the desired design is transferred to the paper by means of a stencil or carbon. With a sharp knife the design is then cut out of the paper, and the glass is placed against a wall and the sand spray turned on it. The sand bites into the glass wherever the paper is cut away. The helmeted operator can tell how fast the gun is cutting by a violet glow caused by the friction of the sand as it passes the gun nozzle. The glass stained various colors makes pleasing panels.



Top, Colored-Glass Design Carved with Sand and Compressed Air; Left, Cutting Design from Cardboard Glued to the Glass; Right, Using the Sand Blast to Impress a Design in Glass

FISH FLOUR FOR HUMAN FOOD IS RICH IN MINERALS

Fish flour is about to be introduced to American palates as the result of recent research by the bureau of fisheries and the bureau of chemistry and soils. Calcium and other essential minerals are brought to the diet by this highly refined and biologically pure product. Fish meal has long been used as a crude food for animal feeding and the flour is a preparation that will bring to the dinner table the same abundance of mineral salts that has benefited animals. The flour is more highly refined than the meals and, in cooking, may be disguised to hide the fish taste. At present it is not available commercially, but experiments have shown that it can be used as a substitute for up to fifteen per cent of white flour in sweet cookies. It is being produced experimentally by drying in a vacuum the portions of fresh fish not now used commercially. When ground to flour it is white, fluffy and attractive, with a pleasant taste and odor and contains from twenty-five to thirty per cent of mineral matter of which nearly half is lime. White wheat flour contains only one-half of one per cent of mineral matter, of which less than one-twentieth is lime. Iodine and copper are other ingredients of the fish product. In baking, the fish taste is concealed by the use of molasses, cinnamon, ginger or other spices.

New Wizardry

Midget Models, Showing How Modern Roads Are Made, and, Left, Metal Models of Concrete Mixer and Road Finisher

WHEN the proposal to send some of the most sacred relics in the George Washington collection to the International Colonial and Overseas exposition in Paris was presented to the National Museum, the authorities refused to allow such priceless possessions to leave their safekeeping.

This led to the production of faithful copies of Washington's sword, scabbard, mess kit, writing portfolio and the Benjamin Franklin staff which are so realistic as to be practically indistinguishable from the originals.

It would have been relatively simple to chisel, cut and carve fairly accurate duplicates of the museum treasures from hardwood. But any expert will tell you that even the artist and scientific illustrator has to stretch his imagination to make wood simulate metal. In this case, Uncle Sam desired to make the copy relics for exhibition in Paris as accurate and authentic as possible, for these duplicates of Washingtonian keepsakes are to be presented as permanent gifts to the French government.

The ideal of the government was to make such accurate copies of the Revolutionary War relics that it would be impossible for the original producer of those articles to distinguish between his handicraft and that of the artist model maker. This, of course, entailed the complete protection of the originals from chemicals, grease, oil, water or other injurious materials during the copying process.

At first it was decided to use special atomizers charged with chemicals which would congeal after being sprayed over the war relics in such manner as to form clear-cut impressions which then could be used as patterns in making plaster copies. That plan was discarded as impractical.

Another plan involved the thorough chilling of the steel sword in an electric refrigerator for several days. The artist was to press hot paper over the ice-cold

in Model Making

Model of Prairie Schooner, Mules and Pioneers, and, Right, Copy of Washington's Sword Made from Original by Use of Tinfoil, Plastic Composition and Casein

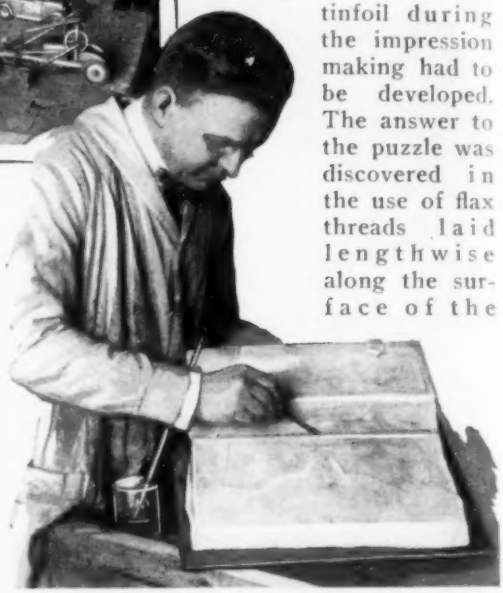
metal as soon as the sword was removed from the refrigerator in order to obtain an accurate impression. It was found, however, that the sword might be damaged if handled similarly because a film of moisture would form between the hot and cold surfaces.

Eventually, one of the government's specialists suggested the use of tinfoil in making a realistic impression of the sword. Small pieces of this material were used to cover the entire surface of the honorary weapon. When this blanket of tinfoil was in place, the artist rubbed each piece lightly with cotton in order to press it firmly against the metal. The result was a perfect copy of the sword reproduced in the tinfoil covering. This tinfoil "overcoat" protected the highly polished metal against any possible injury.

A layer of plastic material, about one-half inch thick, was then placed uniformly over the tinfoil, being pressed into position firmly enough to receive a faithful impression of even the most minute bumps, dents and tiny scratches and lines. This plaster impression and the tinfoil were then removed from the sword, separated and matched together like a child's puzzle game as the model from which the cast of the copy was made.

Neither modeling plaster, plaster of paris nor their related materials were suitable for use in the reproduction of this impression and tests with many substances were necessary before a satisfactory product was discovered. Finally a combination of a certain plastic composition with cheese and casein was developed. Soapstone or talcum powder was added to produce a smooth surface. The casein in the mixture produces a surface as hard as metal which, like steel, can be polished with an ordinary file after setting. After the copy of the war sword was finished, it was painted and decorated with silverleaf in realistic simulation of the original weapon.

The scabbard of Morocco leather was copied in similar manner. This copy is



Top, Making Models of Road-Building Machinery; Below, Copy of Washington's Writing Kit Which, Although Hard as Steel, Shows Texture of Leather

so authentic that even the texture of the leather is reproduced in the most minute detail. The key of the Bastile which almost one and one-half centuries ago was presented to George Washington as a symbol of international friendship by the king of France, is now one of the cherished treasures of a leading fraternal organization. That society loaned the relic to the government in order that it also could be copied in the metal-like plaster.

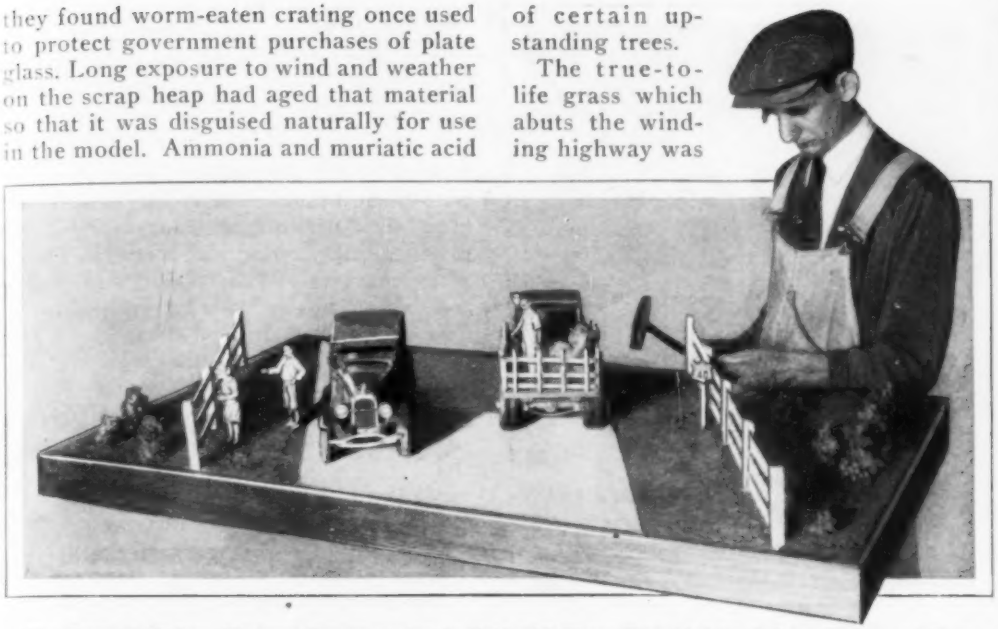
In his will, Washington bequeathed to each of his five nephews one of his swords. It was left to the relatives to make their selections from Washington's military collection in the following order: William Augustine Washington, George Lewis, George Steptoe Washington, Bushrod Washington and Samuel Washington. The will stated that, "These swords are accompanied with injunction not to unsheathe them for the purpose of shedding blood except it be for self-defense or in defense of their country and its rights; and in the latter case, to keep them unsheathed and prefer falling with them in their hands to the relinquishment thereof." Samuel T. Washington, son of Samuel Washington, presented the sword and scabbard which have been copied for exhibition in Paris to the congress in 1843.

Another historical treasure which is beyond the purchasing power of the wealthiest man is a gold-headed staff of Osage orange carried by Benjamin Franklin during his visit to France and throughout the Revolutionary War. Franklin presented the staff to his friend George Washington after Cornwallis surrendered at Yorktown. Samuel T. Washington who inherited the keepsake gave it to congress.

The staff presented a special problem in copying because of its cylindrical shape. An original method of removing the protective tinfoil during the impression making had to be developed. The answer to the puzzle was discovered in the use of flax threads laid lengthwise along the surface of the walking stick underneath the tinfoil. The plastic composition and casein mixture was then applied over the tinfoil to make the impression. After it had hardened sufficiently, the flax threads—their ends were exposed—were pulled out, which facilitated the removal of the cast.

Washington's mess kit offered reproduction enigmas which made the national artists scratch their heads in perplexity. That carrying case was made of ash, pine and chestnut with metal hinges, lock and reinforcements. The wood was pitted and honeycombed with worm holes in addition to being scarred by hard service in the field. Uncle Sam's model makers hunted high and low for aged wood which could be used in making a copy. Finally,

they found worm-eaten crating once used to protect government purchases of plate glass. Long exposure to wind and weather on the scrap heap had aged that material so that it was disguised naturally for use in the model. Ammonia and muriatic acid were used to rust and stain the new metal fittings so that they appeared aged.



The Story of Modern Highway Transportation Is Told with These Tiny Models of Cars, Trucks and Even Road Surfaces; Brass, Steel, Iron, Zinc and Lead Are Being Used in Model Making

Uncle Sam is also sending abroad for educational display the most complete exhibit of the evolution of the American highway ever prepared. It spans the gap of more than 100 years from that pioneering period, when prairie schooners in wagon trains were the only safe and reliable means of transportation between the Atlantic and Pacific, to the current era of cross-country travel in motor cars over some of the best highways ever built. Lilliputian prairie schooners, automobiles and trucks manned by realistic manikins are the headliners in that picturesque show. Both the wagons and motor cars are made to scale, being faithful replicas of regulation vehicles.

The motor-car effigies travel a concrete highway of dwarf dimensions which is equipped with safety fences, traffic signs, highway markers and roadside borders beautified with ornamental plantings. The trees are made of pompoms of wire and rope, colored to simulate nature with shellac dyes applied with a hot iron. In making these imitation trees and shrubs, pieces of rope were cut, opened and unraveled. Wire rope is more satisfactory than jute, flax or hemp in the simulation of certain upstanding trees.

The true-to-life grass which abuts the winding highway was made from carpet with extremely long pile. This carpet was treated repeatedly with a hot soldering iron used like a garden rake to produce various grass effects. Oil paint was used in simulating the natural grass color, being applied as though the artist were painting at his easel on canvas.

The tiny models of road-building machinery, including portable concrete mixers, road finishers, plows, harrows, disk harrows, rollers, tractors, trucks and graders, were made of brass, steel, iron, zinc, lead, copper and other sheet metal. Some of these accurate models, which were made on the scale of three-sixteenths of an inch to the foot, were machined out while others of sheet lead were shaped over special dies made of hardwood. Brick, concrete, bituminous macadam, crushed stone and gravel, bituminous concrete and mixed-in-place bituminous surface-treatment types of highway are represented with the handicaps and hazards involved in their construction. The bricks for the brick highway were made of wood cut with a circular saw filed down fine enough for such simulation.

¶Injuries from splinters cost one state over $300,000 in compensation last year.

Indicator and Dial Box for Silent Office-Signal System That Transmits a Visual Summons

SILENT OFFICE-SIGNAL SYSTEM LIKE DIAL TELEPHONE

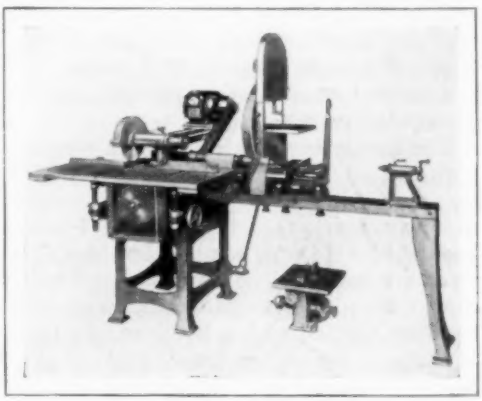
Operated somewhat like a dial telephone, a silent office-signal system to summon executives to the telephone or to receive messages is being employed in Germany. The system depends on visual signals rather than on the constant ringing of bells or other audible calling devices. Indicators for the electric system are in the form of dials like clock faces, except that they contain twenty-five numbers and only one pointer. These indicators are scattered about the building, and when an official is to be summoned, a dial transmitter sets pointers of all the indicators to the number assigned him. Only one audible alarm is necessary, which calls attention to the dial, and if the person wanted answers immediately there is no further audible signal. If he fails to answer, the audible signal is repeated at intervals.

BIG GAME COUNTED FROM AIR BY THE USE OF PLANES

Airplanes are being used in Utah in taking an accurate census of big game. The elk in a region thirty miles long and eighteen miles wide were counted by aerial observers after six flights, this method providing a better check than the periodic estimates resulting from ground observation. The count was attempted after stockmen claimed the elk were becoming so numerous as to do great injury to cultivated lands. The air census showed 351 elk on the range. The counters said that at a low altitude it was easy to spot elk groups. The check was made at a time when there was little opportunity for the animals to conceal themselves and when chances for the drift of herds from one part of the range to another were slight.

ALL UNITS FOR WOODWORKING COMBINED IN ONE MACHINE

All the necessary units for woodworking have been combined into one machine for the shop that has the additional advantage of being portable. Each unit is individually driven by the same motor, but no countershafts, idler pulleys nor multiple beltings to waste power are employed. Power is supplied by either an electric motor or gasoline engine. Included in the equipment is a slide saw for crosscutting, mitering and dadoing, an underslung rip, groove and plow saw, an accurate four-inch or six-inch jointer, a fourteen or sixteen-inch band saw with tilting table, a hollow chisel mortiser, a reversible shaper, a boring machine and a two-speed thirty-six-inch lathe. Any combination of units desired can be obtained with the outfit, although any unit can be operated without the material striking any other unit.



Portable Machine for the Shop That Includes All the Necessary Units for Woodworking

MACHINERY OF THE EARTH AND HOW IT WORKS

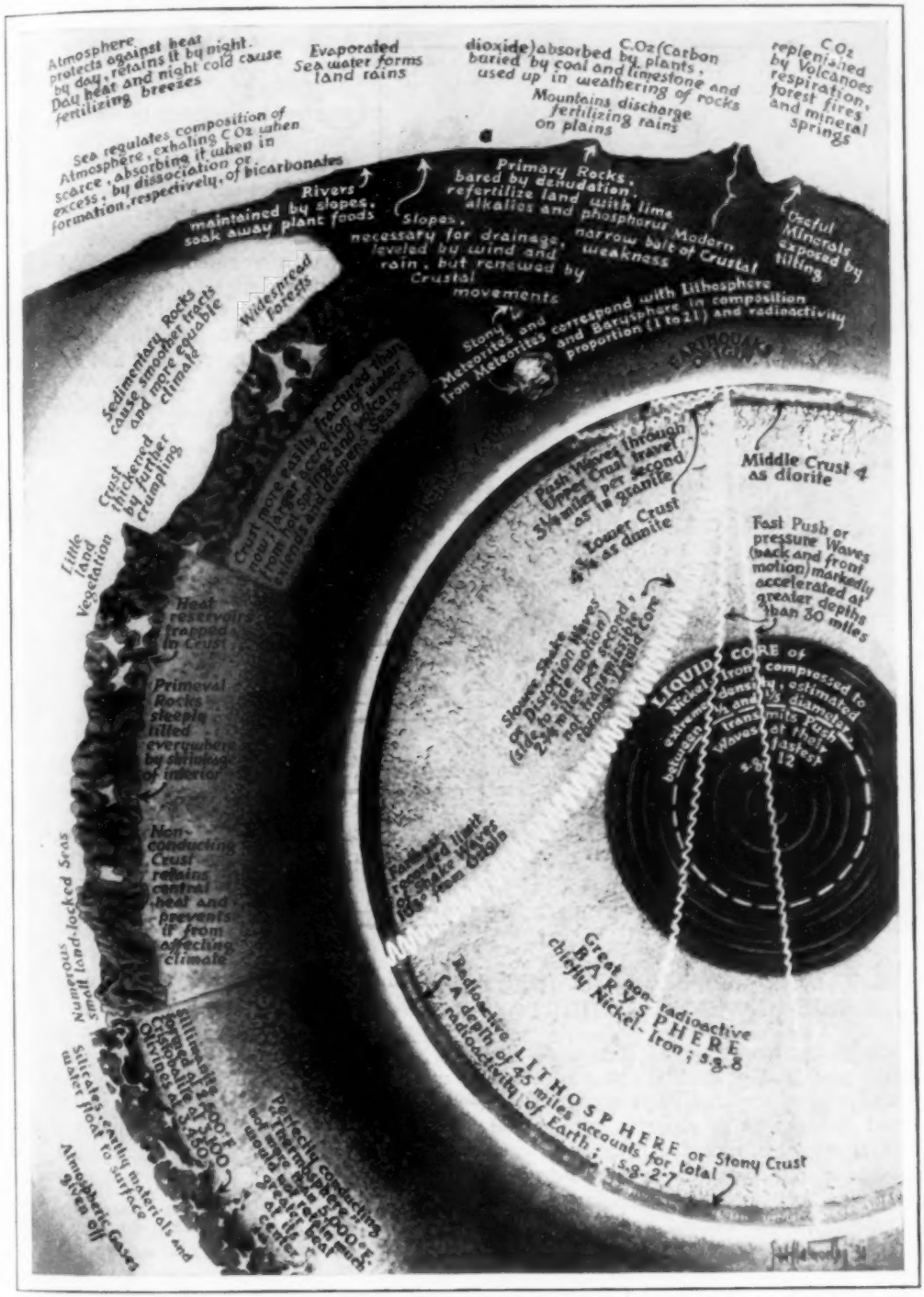
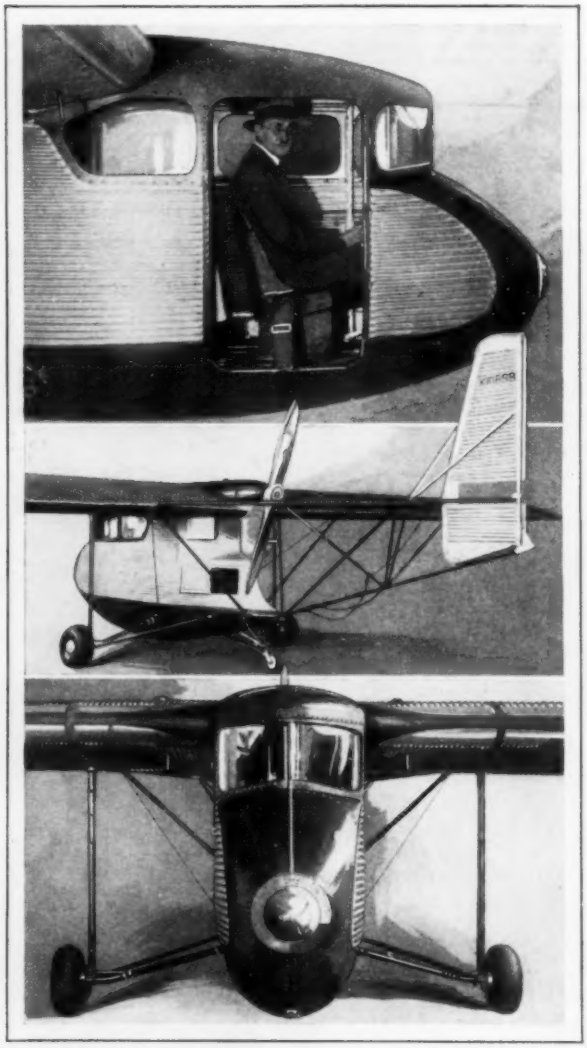

Atmosphere protects against heat by day, retains it by night. Dull heat and night cold cause fertilizing breezes
Evaporated Sea water forms land rains
dioxide) absorbed by plants, buried by coal and limestone and used up in weathering of rocks
C.O2 (Carbon
C O2 replenished by Volcanoes respiration, forest fires and mineral springs
Mountains discharge fertilizing rains on plains
Sea regulates composition of Atmosphere, exhaling C O2 when scarce, absorbing it when in excess, by dissociation or formation, respectively, of bicarbonates
Rivers maintained by slopes, soak away plant foods
Primary Rocks, bared by denudation, refertilize land with lime alkalies and phosphorus
Modern narrow belt of Crustal weakness
Useful Minerals exposed by tilling
Slopes, necessary for drainage, leveled by wind and rain, but renewed by Crustal movements
Widespread forests
Sedimentary Rocks cause smoother tracts and more equable climate
Stony Meteorites and Meteoritic Irons correspond with Lithosphere and Barysphere in composition proportion (1 to 21) and radioactivity
Crust thickened by further crumpling
Crust more easily fractured than now; larger accretion of water from hot springs and volcanoes; extends and deepens Seas
Little land Vegetation
Heat reservoirs trapped in Crust
Primeval Rocks steeply tilted everywhere by shrinkage of interior
Non-conducting Crust retains central heat and prevents it from affecting climate
Shallow Seas
Numerous land-locked Seas
Push Waves through Upper Crust travel 5½ miles per second as in granite
Middle Crust 4 as diorite
Lower Crust 4% as diorite
Fast Push or pressure Waves (back and front motion) markedly accelerated at greater depths than 30 miles
Slower Shake Waves (Distortion Motion) (side to side motion) 2¾ miles per second; not transmissible through Liquid Core
LIQUID CORE of Nickel-Iron compressed to extreme density and transmits Push Waves at their fastest 7.3
CORE of compressed Iron; estimated ⅔ diameter of Earth; s.g. 12
Farthest reported limit of Shake Waves from Origin
Great non-radioactive BARYSPHERE chiefly Nickel-Iron; s.g. 8
Radioactive LITHOSPHERE or Stony Crust to a depth of 45 miles accounts for total radioactivity of Earth; s.g. 2.7
Silicates, earthly materials and water float to surface
Atmospheric Gases given off
Perfectly conducting Thermosphere 5,000° F. not more than 1,000 miles thick would retain heat greater than that at Earth's Center
Olivinites at 4,000° F.
Silicates at 2,000° F.

Diagram Co-Ordinating the Latest Theories of the Composition and Functions of the Earth; Geology Offers Evidence of the Succeeding Crustal Developments as Shown in the Drawing



Views of the "Sky Car," a Flivver Plane Weighing Less Than Half a Ton; It Can Land on a Tennis Court

AIR FLIVVER BUILT LIKE AUTO LANDS ON TENNIS COURT

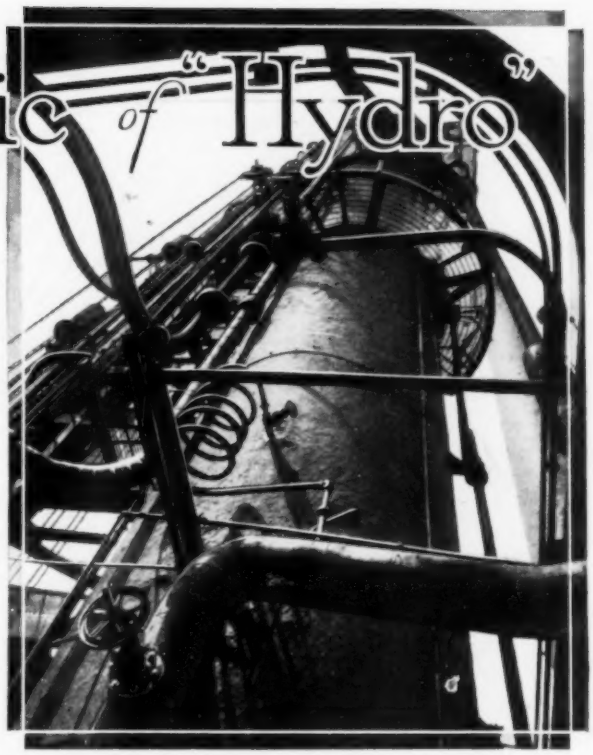
Weighing less than 1,000 pounds and capable of landing on the space of a tennis court, an airplane counterpart of the small automobile is now in production. The tiny plane, called a "sky car," consists of a two-seater cabin suspended beneath a twenty-three-foot wing of full cantilever construction. The ship is built of corrugated metal, and many of the instruments and fittings resemble those usually found on automobiles. There is a Ford ignition switch and safety key on the dash, a self-starter button on the floor and a brake lever, reminiscent of the model-T emergency, that permits application of the brake to either wheel in turning. The rudder for lateral control is operated by floor pedals similar to those with which drivers of the first Fords learned to operate their machines. The monoplane is powered from the rear with a pusher-type four-cylinder air-cooled motor of the inverted design, developing seventy-five horsepower. The ship is expected to sell in the price range of a moderate-priced automobile.

STARS WRITE OWN DATA OF EVENTS FOR SCIENCE

Making the stars write their own records of events interesting to astronomers is the recent accomplishment of the director of an observatory in China. The feat is brought about by a new application of the photo-electric cell, or electric eye, and involves the construction of an apparatus of extreme delicacy and sensitivity. To measure, for instance, and record the minute amount of light reaching the earth from a star, the rays are reflected by a mirror and focused through a condensing lens upon the electric eye, setting up a weak current that is amplified through vacuum tubes until it can operate an electromagnetic relay. This causes a stylus connected to it to write an irregular line on a revolving drum which represents the variations in light received, while sensitive milliammeters record current strength. Synchronously an astronomical pendulum clock writes a time curve on the same drum. Other applications are the automatic recording of the meridian passage of any star, saving astronomers tedious night vigils, and the study of blinking stars. These seem to blink because of movements in the upper atmosphere, and the study of this phenomenon may eventually help to reveal facts of importance to meteorologists.

The Magic of "Hydro"

By J. W. HARRINGTON



Where Crude Oil Is Taken Apart and Then Put Together Again in New Proportions

YOU owe much these days to the magiclike "Hydro." It increases the yield of gasoline for your car, gives new foods for your kitchen and serves scores of household uses.

Hydro is short for hydrogenation, a process by which the bubbling of the gas hydrogen through various liquids strangely changes them. Some, as though touched by a wizard's wand, come out measuring more than they did—others are transformed to solids.

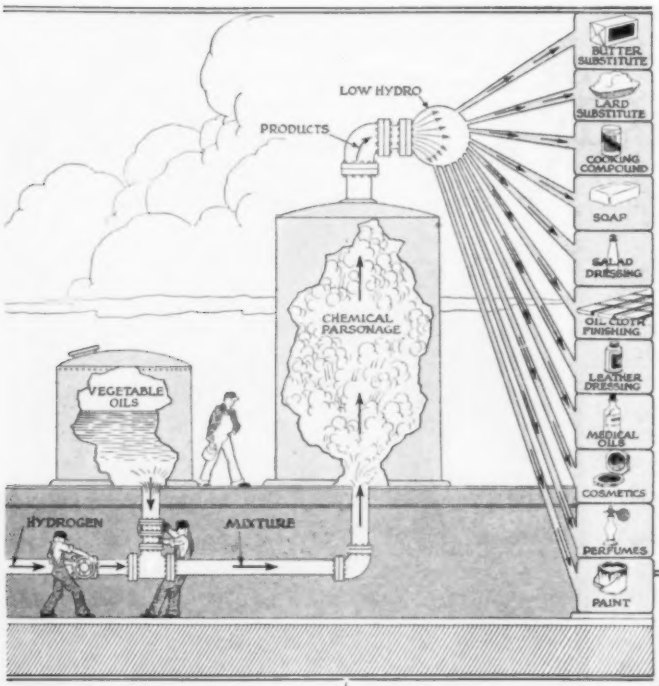
The union of hydrogen with various substances is due to the presence of agents known as "chemical parsons" because they unite the hydrogen with other elements without being themselves affected. Technically a parson is a catalyst —its title being derived from the Greek.

Discovery of the action of parsons was largely accidental. A dye manufacturer lost a batch of material because some one had thrown away the parson—an old copper lid. He rescued it from the dump and all was well the next time. Parsons also keep apart or disunite. In that case they may be considered as acting as divorce judges. Unless conditions are exactly to its liking the chemical parson refuses to officiate. Some are so delicate that they go dead from the fumes of sulphur; others pass out from arsenic. When this happens, the chemist has to find out who or what "poisoned the parson." The hydrogenation of coal and crude oil was held up for years because both contain more or less sulphur, even a trace of which would interfere with the functioning of the catalysts. Finally parsons of a sturdy character and not squeamish about brimstone were found to do the work. They are aided by tremendous pressure and intense heat.

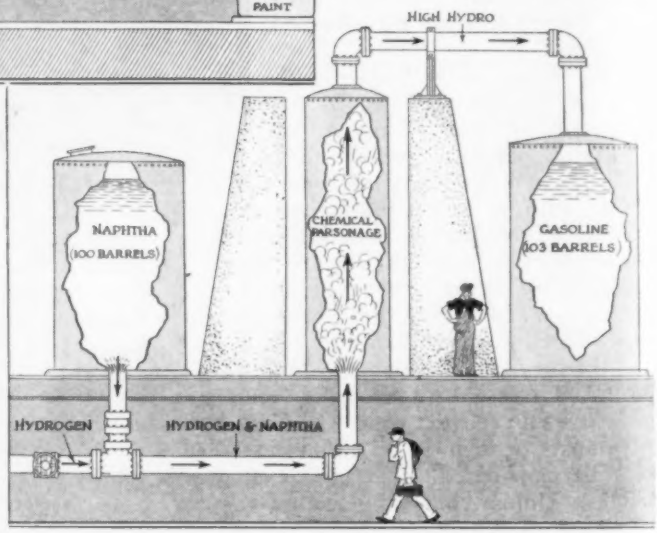
Hydro plants for deriving gasoline from petroleum wastes or from petroleum products for which there is not so brisk a demand as for motor fuel, are best situated at refineries. The fluids to be converted are heated up to 932 degrees Fahrenheit, about five times the temperature at which water boils, and are placed under a pressure of 3,000 pounds to the square inch.

In this state they are forced into huge cylinders or retorts. Then they are rushed through a layer of parson, usually coarsely ground iron oxide, while at the same time a stream of hydrogen is being delivered into the receptacle. Such is the steel chapel in which the union of the product and hydrogen takes place.

Ancient philosophers believed the earth and its gases to be made up of four things —earth, air, fire and water. But the modern scientists find a place for ninety-two elements and some believe that eventually we will find everything compounded from a single substance, say, hydrogen. In the meantime, however, the ninety-two ele-



leading derivative of petroleum—gasoline. Crude oil is a highly complicated mixture of hydrocarbons which may be distilled off and separated at varying degrees of temperature. Once kerosene was the most valued, then came gas and electricity and cut down the sale of that illuminant. The automobile was invented and motor fuel took the lead, and a brisk demand also appeared for motor oils or "lubes." To get his gasoline, however, the refiner had to handle a lot of oil and had all kinds of resi-



ments are the chemists' building stones. Of these, hydrogen and carbon are the most important.

The results obtained from the hydrogenation of petroleum wastes and by-products defy ordinary arithmetic. The first plant in this country for the working of the process was a 100-barrel-a-day experimental one at the Baton Rouge refinery of the Standard Oil company of Louisiana. Based on the researches made there, the Standard Oil of New Jersey established at Bayway, N. J., a 5,000-barrel-a-day works which is now in operation. The process was originated by a German chemical and dye concern, the I. G. Farbenindustrie, which in connection with the Rockefeller interests is licensing its use in the United States. It is announced that no monopoly of its methods is intended.

Every refiner is faced with the problem of disposing of certain products, for which there is not so brisk a demand as for the due products left on his hands. He has tried to meet this situation by the "cracking" process, which breaks up the molecules and gives him more "gas."

Then came hydrogenation which adds atoms of hydrogen where they will do the most good. The result of that combination often is more liquid than there was in the tanks in the first place.

From 100 barrels of low-grade lube, for instance, hydro gives ten barrels of gasoline; twenty-nine barrels of gas oil, which is used by the illuminating gas companies,

and sixty-five barrels of a lubricating oil described as of much better quality than the original. This nets the refiner 104 barrels, an increase of four over his stock, and all of the products are more useful and more salable than the one which was treated. All are freed from the taint of sulphur. From a thick asphaltlike residue, with strong sulphur traces, the process produces from 100 barrels 101 barrels, of which thirty are gasoline and seventy-one gas oil. The most startling result, however, is the conversion of 100 barrels of cracked naphtha, something by no means easy to sell, into an equal volume of high-grade gasoline, of an antiknock grade, and devoid of sulphur.

In low-pressure hydro, unusual progress has been made, especially in the processing and treatment of edible oils. A pressure of only two or three atmospheres and a comparatively moderate heat are required. The chemical parsons, as the products treated are for food generally, are of exceptional purity and often quite expensive. Platinum, cadmium, nickel and such elements are employed to tie the hydrogen knots. One of the largest fields for "low hydro" is the hardening of cottonseed, corn and coconut oils into solid or semisolid fats which are made into substitutes for butter and lard, and other widely advertised cooking compounds.

A strange twist of the threads of fate is that the hydro process is largely responsible for the revival of whaling. In the palmy days of New Bedford and Nantucket, men made fortunes by killing the sea's largest inhabitant and trying out its oil, with which the world lighted its lamps. Petroleum put a crimp in whaling, and gas and electricity flattened it as a paying industry. Now whale oil, hydrogenated and odorless, makes an excellent soap base. The Koreans and the Japanese eat whale steak and enjoy it hugely. Shark oils are used as medicine, similar to that taken from Norway's pride, when deodorized. The so-called tasteless cod-liver oils are hydrogenated and castor oil is so treated before it is warranted to trusting childhood.

In all its phases, therefore, hydrogenation is working alchemic wonders and serving the human race.

BOY PRINCE WORKS IN GARAGE TO LEARN MECHANICS

Prince Michael of Rumania at Work as a Mechanic in a Garage in the Royal Palace

Prince Michael of Rumania, once the titular king of that country, is learning to be a mechanic. The lad has started on an engineering apprenticeship in a workshop in the lower portion of the royal palace, containing equipment for every type of automobile-repair work. Under the supervision of an instructor, the boy started out by making a brass cube to scale and a door latch. Later he was put to work learning the parts of an oil drill and the uses of different types of fuel, including instruction in the art of welding metals. A course in plumbing and soldering is to be followed by practice in the construction and repair of motor engines.

¶The Popular Mechanics' Bureau of Information offers its free service to all readers of this magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished.

New Conveniences

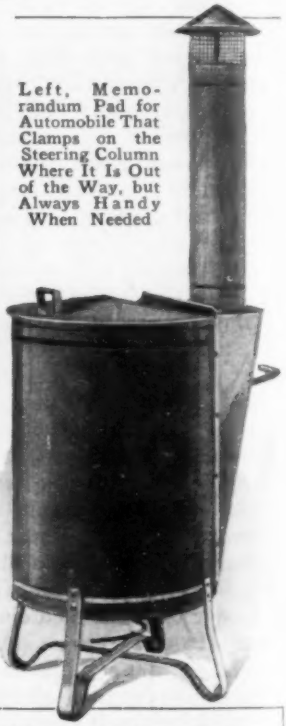
A Safe Exerciser for Babies in the Form of a Jumping Seat on S-Shaped Springs; the Washable Cloth Is Quickly Removed for Cleaning

Sturdy Electric Mixer That Can Be Used to Beat and Whip Potatoes

Combination Cooking Set That Will Not Scorch or Burn; Utensils Are Used Like Any Other Frying Pan or Griddle

Left, Memorandum Pad for Automobile That Clamps on the Steering Column Where It Is Out of the Way, but Always Handy When Needed

Receptacle for Bath-Salt Tablet Inside of Sprayer; the Tablet Softens and Perfumes the Water from the Spray

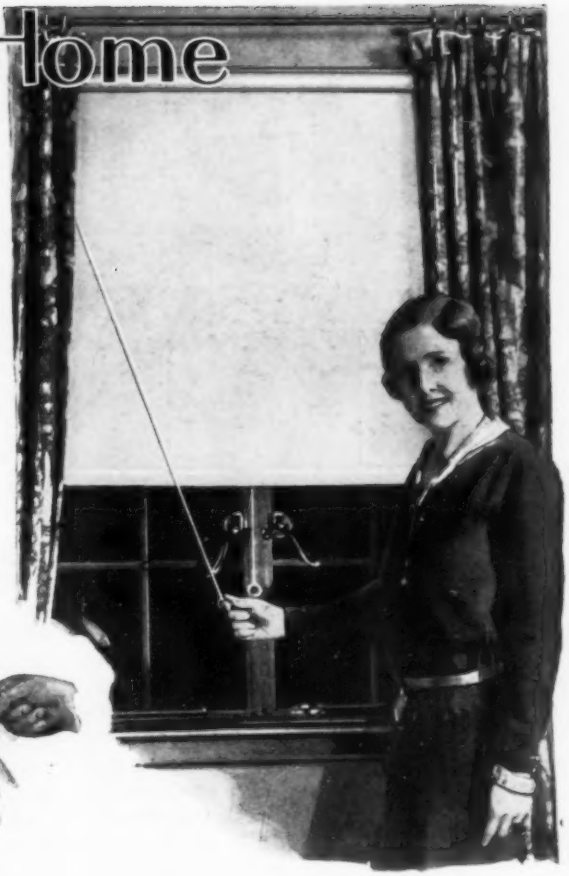


Garbage Incinerator That Utilizes Dry Refuse as Fuel to Burn the Garbage; Handle at the Bottom Operates a Dumping Grate

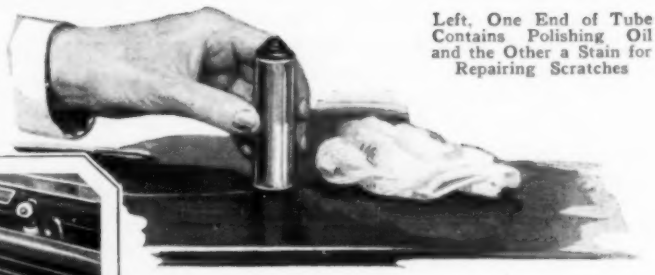
for Your Home

Right, Springless Window-Shade Roller That Is Lowered in Usual Way, but Is Raised by Pulling Cord at Side of Window

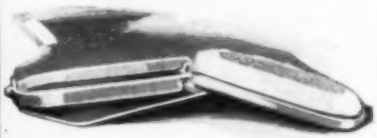
Holder with Handle for Sifter-Top Cans; It Is Obtainable in Various Colors



Handy Turnover Pan That Finds a Use in Every Kitchen for Upside-Down Cakes, Corn Popping, Omelets, Corn Bread, Two-Layer Cakes and for Warming Rolls

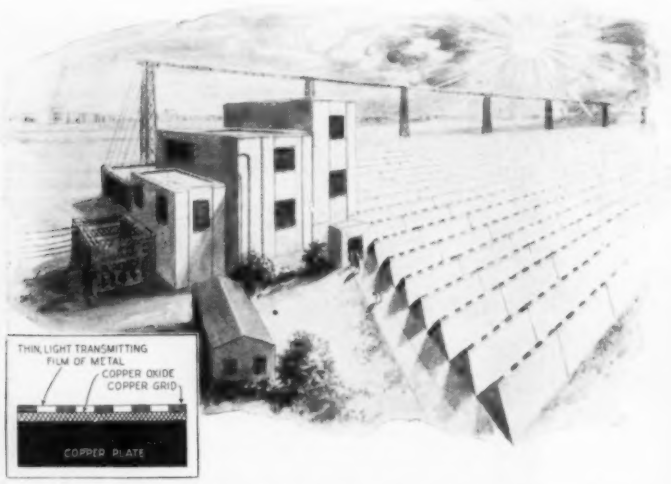


Left, One End of Tube Contains Polishing Oil and the Other a Stain for Repairing Scratches



Below, Combination Shoe Brush, Shoe Horn and Bottle Opener, All in One Compact Unit; Shoe Horn Folds Back When in Use

Oven Scoop That Will Handle Everything from a Baked Potato to a Twenty-Pound Roast



How Light Cells May Be Used to Produce Electric Energy from Sun, and Diagram Showing Construction of Units

ELECTRICAL ENERGY FROM SU[N] PRODUCED BY LIGHT CELL

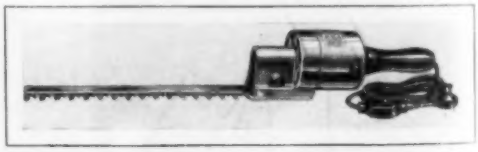
Inventive genius appears to be nearing a solution of the problem of using the vast energy of the sun for human purposes. Dr. Bruno Lange, a Berlin scientist, recently invented a device which converts sunlight into electric energy more completely than ever before, at a price which may compete with present hydroelectric installations. Silver selenide is the substance which, he has found, best does the trick of converting light to electricity. A sheet of metal is covered with the substance, which in turn is coated with a transparent layer of a second metal. Light passing through the transparent film sets up a current between the two layers of the metallic sandwich, developing fifty to 150 times the energy obtained from a similar sandwich of copper oxide between two layers of copper, the immediate forerunner of the silver-selenide cell. A copper-oxide cell, three inches square, has driven an electric motor by dull sunlight for several months in a Berlin laboratory, and rival patents have been taken out in England on the copper-oxide invention both from America and Germany, Dr. L. O. Grondahl and Dr. Paul H. Geiger, of Pittsburgh, being the American inventors, while the Westinghouse company owns the American patent. It is estimated that the cost of installing the copper sandwich on a large scale to trap the power of sunlight would be $25,000 per kilowatt, whereas the hydroelectric plant can be erected at a cost of from $100 to $300 per kilowatt.

QUALITY OF MUSIC AFFECTED BY HUMIDITY

Music, when heard at a distance, has an entirely different quality on a dry day from that on a humid day and experiments have shown this to be due to the fact that sounds of high pitch can travel farther in moist air than in dry air. The frequencies of sound most affected by atmospheric moisture are those from 2,000 per second upward, including the two topmost octaves of the piano. Sounds of middle and low pitch, such as the principal ones in the human-voice range, are hardly changed at all. It has been known for some time that tones above audible sound were affected by the weather, but it was not supposed that ordinary sound was so influenced. The phenomenon is of concern principally in a very large auditorium where high notes may appear ten times as loud in humid weather as in dry.

ELECTRIC HEDGE CUTTER TRIMS SHRUBBERY QUICKLY

Shrubbery and bushes now can be trimmed by electricity with a small hedge cutter that can be operated easily with one hand. It saves much time and takes most of the work out of this task that is slow and tedious with the ordinary two-hand clippers. The compact, portable trimmer



Electric Hedge Cutter That Takes Most of the Work Out of the Task of Trimming Shrubbery

can be connected to any light socket and a one-eighth-horsepower motor furnishes enough power to clip the toughest twigs.

EFFECT OF AGE UPON SPEED FOUND TO BE SMALL

Not all old people are slow workers. Probably about one-third of the persons over seventy-four years of age, for instance, could release the accelerator of an automobile at the approach of danger as quickly as the average adult. These facts were brought out by recent tests conducted by Dr. Walter R. Miles, professor of experimental psychology at Stanford University, who found aged persons differ in speed just as do younger people. Mental age, it was found, does not in all cases run parallel to chronological age, indicating that an arbitrary ruling that all individuals must retire on reaching a certain calendar age is often detrimental to both the individual and the employer.

PISTOL-GRIP HAMMER SAWSET WITH TRIGGER ACTION

So compact that it can easily be carried about in the tool box, a hammer and anvil sawset, with pistol grip and trigger action, is being offered for all handsaws. A light pressure on the trigger draws a hammer back against a spring which is compressed and then released by a small dog, striking the saw with a sharp blow. The result is a uniform set regardless of whether the saw has soft or hard spots. There is an adjustment screw on the end of the barrel holding the spring to obtain more or less set. It can be used on all kinds of band saws.

SLOW MOVIES OF FLYING BIRDS AID STUDY OF GLIDING

To study the characteristics of soaring flight for the benefit of motorless flying, a teacher of a gliding school in East Prussia has trained falcons to fly within a limited space and made moving pictures of them. The films are then projected at slow speed for close inspection.

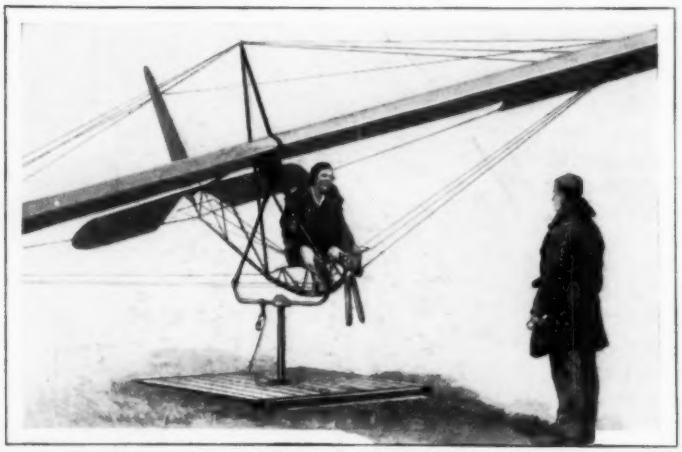
Automatic Golf Tee for the Driving Range; It Delivers a Ball When a Pedal Is Pressed

AUTOMATIC GOLF TEE DELIVERS BALLS READY FOR PLAY

Taking the stooping out of golfing, particularly in driving practice, an automatic tee delivers the balls ready to play when a pedal is pressed. The device consists of an upright cylindrical container for the balls, curved at the lower end and terminating in a tee. A small size for miniature courses contains also an ash tray, watch holder and marker.

BATH SPRAY IS CONCENTRATED INTO A SMALL AREA

Instead of spreading a stream of water, a bath sprayer now is being produced that concentrates it into a small area to provide both a spray and some of the power of a steady stream of water. It is particularly suited for shampoos where the spray is to be concentrated on the head alone.



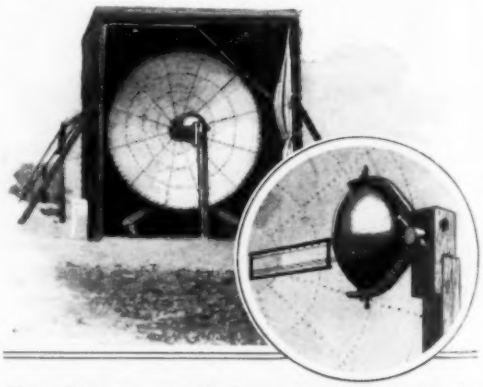
Safety Glider for Students; the Craft Has Standard Controls and Is Attached by a Universal Joint to Top of a Steel Plunger

SAFETY GLIDER FOR STUDENTS IS MOUNTED ON SHAFT

Experience in handling a glider is obtained by the novice flyer without leaving the ground through the use of a safety instructor recently invented. A full-sized glider with standard controls is mounted on a steel plunger, being suspended on a universal joint. This arrangement allows the student to manipulate the craft as if it were in actual free flight.

SHORT-WAVE RADIO TELEPHONE IS SUCCESS IN TESTS

Successful two-way radio-telephone communication was recently carried on across the English channel on eighteen-centimeter wavelength with a one-inch aerial. The demonstration was conducted by the International Telephone and Telegraph laboratories in England in co-operation with the laboratories of Le Materiel Telephonique in Paris. In the tests, oscillations of wavelengths as low as ten centimeters, and designated as "micro-rays," were used for the first time to provide a two-way radio-telephone or telegraph circuit. Power of only half a watt was used, just enough to light a flash bulb. The demonstration indicates that the ultra-short waves now will become available for commercial radio transmission, thus opening an entirely new field. The quality of speech received was not only up to the standard of a good phone circuit, but reception was unaffected by weather conditions to which the very short waves are immune. The heart of the apparatus employed is a giant reflector, ten feet high, which projects into space the micro-rays oscillating 1,600,000,000 times a second. These tiny waves offer many striking features as compared with the more usual wavelengths. For instance, the shortness permits the use of electro-optical devices more usually associated with light, such as reflectors or refractors in addition to the diminutive antenna system, and the waves, by means of reflectors, can be directed along a narrow band, like rays of light. Outgoing signals are applied to a micro-radion tube in which the high-frequency oscillations are generated. The range of frequencies available in the micro-metric wave band, between ten and 100 centimeters, is nine times as great as in the whole of the ordinary radio field. The short waves also are expected to be important for television which requires a broad frequency range. By using the short waves, a wide band can be allocated to television without causing any ether congestion. For navigation purposes and for radio beacons, the system has many advantages and also offers a method for secret communications by radio between warships at sea.



Huge Reflector and the Transmitter Used for Radiophone Communication on Short Waves

High Brows and Brains

HIGH foreheads do not mean brains any more than big men mean intellectual giants. This popular fallacy has been definitely exploded by Dr. Ales Hrdlicka, internationally known scientist, of the National Museum, Washington, D. C., who has just completed a series of highly interesting examinations of various types of human skulls.

According to Doctor Hrdlicka, if high foreheads mean brains, the Eskimo would be superior intellectually to the white man. Furthermore, the common, full-blooded American colored laborer often has a slightly higher forehead than the educated American white.

Doctor Hrdlicka has been studying this problem ever since 1894. He has investigated not only the forehead but other parts of the head structure of most of the major races known to man.

"Studies show," says Doctor Hrdlicka, "that the height of the forehead is not a safe gauge of intelligence. Indeed, if you take an individual and simply judge him by his forehead alone, nine times out of ten you will be more or less wrong. However, the situation about true intellectuality is entirely different if you lay less stress on forehead size and instead emphasize the importance of the brain structure itself. But more of this later.

"A sloping forehead doesn't mean brutality or low intelligence by any means. No doubt there are two good reasons for this generally accepted fallacy, one being that the main headquarters of intelligence is in the frontal lobes of the brain, and the other that many observers have noted a sloping forehead to be prevalent among certain criminal types, some savages, ancient men, and generally speaking, among the lower animals and anthropoid apes.

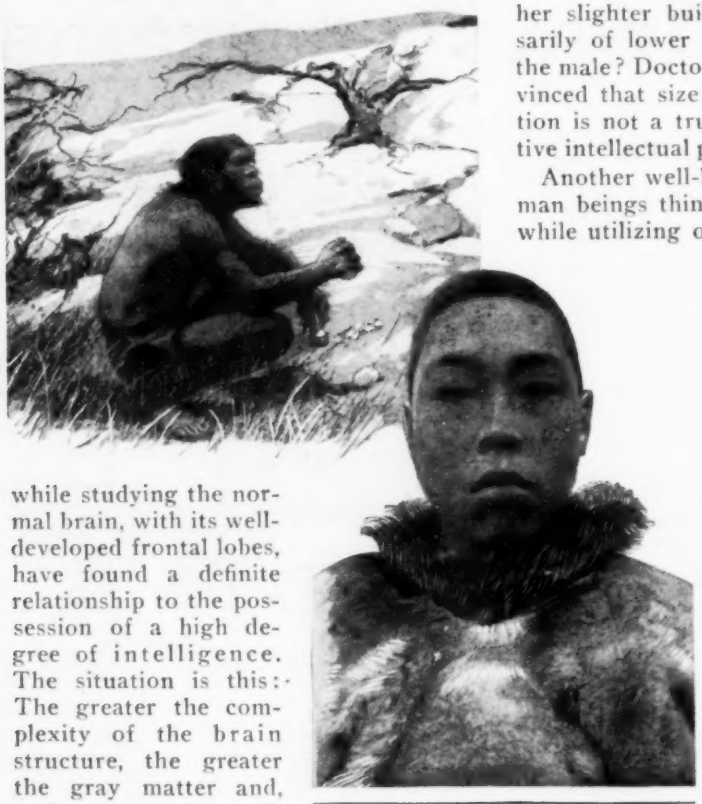
"This view, however, although it has some natural foundation, is not at all true. In many known cases, such a sloping forehead has existed along with a brain of high intelligence. In this connection I have examined the foreheads of

Scientist Demonstrating Method of Taking Exterior Brain Measurements of a Living Person

hundreds of type specimens of the major leading races and found that in the case of most of these sloping foreheads it is not the upper section of the brow that actually is depressed but the lower portion that has been carried forward more than usual. The physiological result is that the brain size is not affected in such a way as to forbid strong intellectual qualities."

Doctor Hrdlicka goes on to explain some other curious situations that may exist and give the casual observer a wrong impression of "highbrowism." A man, for instance, may have a broad skull which serves to take the attention away from the fact that the forehead itself is rather low. Or in similar fashion his hair may recede from his forehead, due entirely to baldness, to such an extent that the brow itself gives an erroneous impression of height.

Now when you come to consider brain size and structure, that's something else—you are on a new line of investigation entirely. This is matter suitable only for the attention of the trained scientist. Such experts, Doctor Hrdlicka points out,



Primitive Man with Low Brow and Sloping Forehead Did Not Necessarily Possess Low Intelligence, Any More Than the Eskimo and His High Brow Rate High Intelligence

while studying the normal brain, with its well-developed frontal lobes, have found a definite relationship to the possession of a high degree of intelligence. The situation is this: The greater the complexity of the brain structure, the greater the gray matter and, under normal conditions, the greater the potentiality of the brain.

Now, here's a fact that probably one person out of a thousand doesn't realize, that, while it is true that large brains usually contain much more gray matter and therefore more intelligence than smaller ones, nevertheless there are comparatively small brains of such complex and refined patterns that they enable the possessor to take an outstanding place in his particular line of mental endeavor. Such brains, Doctor Hrdlicka says, not infrequently are found in people of small stature and slight build. Outstanding examples of this type are the famous artist Raphael and the remarkable orator Gambetta.

Then, too, there have been instances of sizable brains where the possessor shows slight intellectual ability. Here again, the reason lies in the complexity and refinement of brain matter. Along this general line of thought, the natural question arises, is the brain of woman, due to her slighter build and head size, necessarily of lower intelligence than that of the male? Doctor Hrdlicka says he is convinced that size of brain in this connection is not a true index of the comparative intellectual power of men and women.

Another well-known fallacy is that human beings think and work intellectually while utilizing only the front or forepart of the brain, whereas, in truth, the entire brain is necessary in all mental work.

"The frontal parts," Doctor Hrdlicka explains, "serve the higher mental qualities, while the other sections are largely concerned with sensory and motor brain processes. As you cannot have an image without visual impression, you must have the whole brain working as a unit. Thus, if you had all forebrain and no hindbrain, your thinking processes simply would not coordinate, very much as if you had an auto, cut off a large section of it and then tried to run the remaining part.

"Personally I consider the brain to be the most wonderful machine nature has achieved. There are 10,000,000,000 nerve cells in the brain, every one of which is connected and related, all organized in a remarkable fashion and each with an important function to perform. The widely advertised wonders of the radio pale in comparison with this amazing co-ordination of man's most important mechanism.

"The brain is a reservoir where everything is received, distributed, acted upon, reflexively or voluntarily. Its potentialities are such that no scientist, nor group of scientists in the entire world, has been able to come anywhere near gauging its magnitude and refinements. Even the simplest thought is an accomplishment which exceeds the highest and most complicated machine man has invented.

"Just as every machine needs various

energy materials, so the brain requires different foods for the performance of its duties, and, like machines, it gives off different gases. It is these gases upon which the physiological chemistry of the future, laboring to solve the hidden mysteries of the living brain, will concentrate its studies. At the present time this promising line of scientific investigation is being given close attention by science."

ONE LARGE CAKE OF ICE COOLS REFRIGERATOR ALL SUMMER

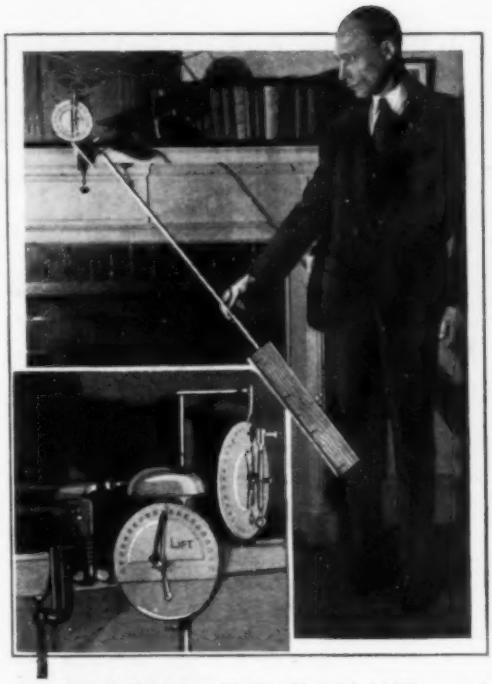
One cake of ice lasts a refrigerator at Iowa State college all summer, but the chunk is six feet high and six feet in diameter. The economical icebox cost only about $50. It consists of two tanks, one six feet in diameter inside another that is eight feet in diameter and nine feet high. Sawdust or similar insulation is used between the walls of the tanks and a cooling compartment is built under the inside tank. Ice is frozen in the winter in the inner tank, which is then covered with about sixteen inches of insulation. The solid chunk of ice formed in the winter will last from spring until fall.

WRITING GUIDE ON CARDBOARD TEACHES PENMANSHIP

As an aid in mastering the proper shapes of the letters of the alphabet in writing, a penmanship guide on heavy cardboard is being offered. Outlines of the letters are depressed in the cardboard and the writer traces and retraces these outlines until the shapes become stamped

Cardboard Writing Guide in Which Letters of Alphabet Are Depressed to Make Tracing Easy

in the mind so they are made without the aid of the tracer.



Aerodynamic Pendulum Used to Test Model Plane, and Dials Which Indicate the Lift and Drag

MODEL PLANES EASILY TESTED BY PENDULUM

Airplane-model builders who do not have access to a wind tunnel can test the efficiency of various types of craft by means of an aerodynamic pendulum which reproduces free flight conditions and which is simple and inexpensive to construct. The pendulum was made by Alfred G. Leigh, a professor of aeronautics, to measure lift and drag of a model under conditions resembling those of a plane in free flight. The instrument may be attached to a shelf, door or nearly anywhere indoors. On the upper end are located a lift-registering dial and another to show drag. At the other end the model is fixed. The arm of the pendulum is raised vertically above the dials and is then permitted to fall or swing by its own weight. This measures the distance that the model travels as well as the lift the wings exert. As the pendulum swings along two planes, the drag is recorded along the vertical plane, and the lift is measured by the amount of deflection of the pendulum from the vertical plane. It is also possible to set the model at any desired angle of incidence, which is shown on a special dial.

ALTERING A. C. DX-TUNER FOR TELEVISION SIGNALS

In answer to numerous inquiries for an a.c. short-wave tuner, employing several r.f. stages for the reception of distant television signals, the following suggestions are given for altering the a.c. DX-tuner described in the October, 1930, issue. This selective broadcast tuner was designed for extremely high gain, and, owing to its unusual construction and simplicity, may be made to tune to the television band with ease. The tuning condensers which were formerly .00035 mfd. are now changed to .00025 mfd. and ganged in the same manner. The same make and type are used so that the change will be very simple. In addition to the tuning capacities it is also necessary to change the trimmer condensers to a lower value. These are reduced to 16 mmfd. each. The next, and most difficult, alteration is to reduce the number of turns on the various coils. This must be carefully done in the manner shown in Figs. 1 and 2. The shields are first removed to expose each stage, as shown in the upper photo. Starting with the coil on the extreme left, using a thin knife blade or awl, count 40 turns up from the bottom of the coil and separate this number of turns from the rest of the coil.

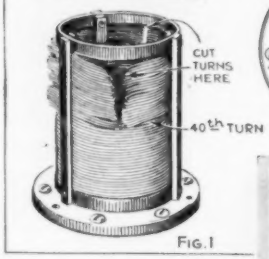


FIG. 1

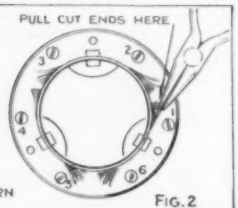


FIG. 2

Care should be taken not to injure the insulation on the lower 40 turns. The upper winding is now cut at three points, as shown in Fig. 1. After cutting the turns and removing the wire with a pair of pliers, in the manner shown in Fig. 2, the insulation is scraped from the end of the top turn, and a flexible lead is soldered from this point to tap No. 6 on the coil base. One point of great importance is to make sure that the same number of turns are on each coil and that all of these turns remain in their original position. The only remaining operation is to remount the coil shields on the chassis, as shown in the lower photo, and rebalance the set in the manner outlined in the October article. The tuner consists of four r.f. stages employing type-24 tubes and the usual type-27 detector.

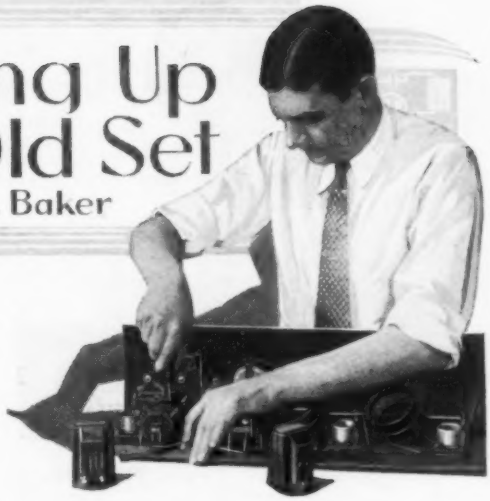
It may be used in connection with any good resistance-coupled television amplifier unit.

Replacing Damaged Speaker Cones

When marking out the paper to replace a cone-speaker diaphragm, a protractor is necessary in order to arrive at the correct angle for the V-shaped cut-out. If a protractor is not at hand, a condenser dial will do for the purpose. Using a dial of the 180° type, cut out a piece covering 52° on the dial, and form the cone. It will have a 120° angle at its apex.—J. B. Bayley, Irvington, N. J.

Pepping Up Your Old Set

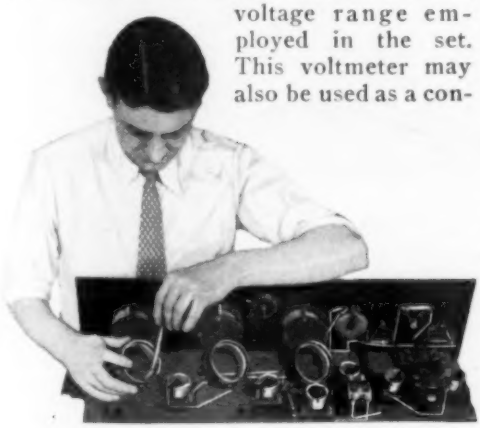
by F. E. Baker



PART I

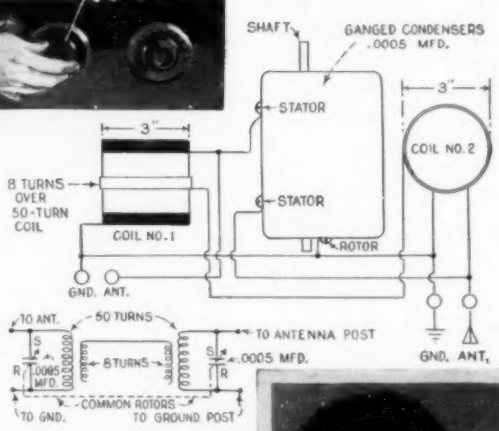
THERE are many old receivers, and some not so old, that can be made to perform more like the latest sets by a few simple additions, changes or adjustments that anyone can make for himself. In fact, many of the older sets, when not located too near powerful broadcasting stations, still bring in DX-signals that would tax the ability of the very latest models. Old sets of the neutrodyne type, or similar tuned r.f. circuits, were quite sensitive but lacked the selectivity and tonal quality of present-day receivers.

To begin with, any radio set, regardless of type or model, must be checked occasionally to make sure that the tubes are in good condition; if B-batteries are used, they must be completely renewed at least twice a year in order to obtain best results. The storage battery needs little attention, if a good charger is used, but the level of the electrolyte must be carefully maintained. A and B-eliminators, used to power sets of this type, must be checked at intervals with suitable voltmeters. A high-resistance voltmeter, of the 1,000-ohm-per-volt type, is used for B-eliminators and it must cover the full voltage range employed in the set. This voltmeter may also be used as a continuity meter and for checking power packs in a.c. sets. An inexpensive 50-volt meter may be used for checking B-batteries, but not for any B-eliminator or power pack. The next step, in pepping up an old receiver, is to examine the antenna and ground connections and make necessary repairs. If the antenna has been up several years, it should be taken down and rebuilt. Stranded, enameled antenna wire and good insulators cost little and yours may be badly corroded and inefficient.



The photo at the head of this article shows an important step for better tone quality in any receiver more than two or three years old. It consists in substituting audio transformers of modern design for the obsolete ones in the set. A good average ratio for these transformers is 3½ to 1, and at the present time they will cost less than the originals. All soldered connections should be inspected very carefully and all nuts tightened. Loose turns on r.f. coils may be held in place with collodion, and if the set has been in a damp place, it should be thoroughly dried out. This may be done by placing a 60-watt lamp on a drop cord inside the cabinet, or by setting the cabinet near a radiator for a reasonable length of time. Batteries should never be exposed to high temperatures and should be removed if the set is placed near a radiator. In tropical countries, dampness will put a radio set out of commission very quickly if pre-

cautions are not taken. Loose or corroded rheostats should be replaced, and if the gridleak is an obsolete graphite strip that has long ago lost its rated value, modern resistors will do much to pep up the old set.



Ganged tuning condensers are convenient but not absolutely necessary, as finer tuning may be done with separate dials unless the trimmers on the ganged-condenser unit are carefully balanced. If all the dials do not read full scale when the rotor plates are all in, loosen the setscrews on the shafts and reset them as shown in the upper photo on this page; the lower photo shows a simple method of removing dust between the condenser plates with an ordinary pipe cleaner.

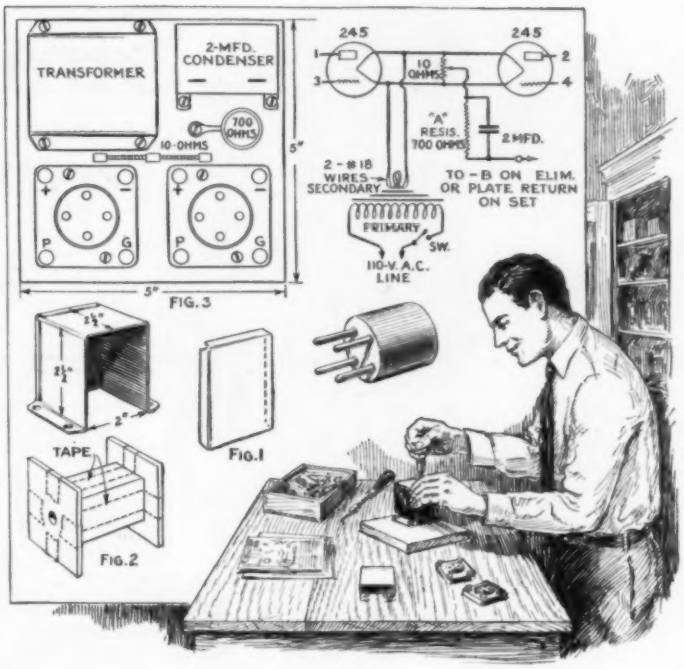
One of the most common causes of trouble in old sets is the filament switch. Very few of these switches used on the older sets were in good working order after the first year; a new switch costs little and means much.

When old sets are used in crowded localities, near powerful stations, the need for better selectivity is quickly noticed. A good wave trap is the easiest and most effective means of overcoming this difficulty. The parts need not be expensive, and the experimenter will usually find them on hand. A tested wave trap is shown in the detail on this page. The 8-turn coil of No. 32 d.c.c. wire is wound over the center of the 50-turn coil of No. 24 d.c.c. wire, and both coils No. 1 and No. 2 are exactly alike. Selectivity may be increased by removing turns from the open ends of the 8-turn coupling coils or decreased in the opposite manner. When mounting the coils, keep them at right angles as shown; the unit may be made up in breadboard fashion and housed in a small cabinet. The rotor of the ganged condenser is common with the frame. This unit is merely connected to the ground and antenna posts of the set on one side and the antenna and ground direct on the other. In common with all wave traps this one uses some of the signal energy, but the results are well worth while in cutting through strong locals. When the experimenter wishes to operate a more powerful speaker with his old set, an adapter to be described may be used if a source of 110-volt 60-cycle a.c. is available. For filament supply, the type-45 power tubes require 2½ volts, and the small homemade transformer supplies

this voltage and the necessary amperage. These tubes operate on a grid bias not used on other amplifiers, and this is taken care of in the adapter without affecting the set in any way. The adapter is a complete unit in itself, and tube-base plugs are used for plugging it into the amplifier tube sockets.

This compact unit may be quickly connected to any battery set employing two audio stages, and, when the connecting plugs are removed, the original tubes may be replaced in the receiver without disturbing the circuit.

The schematic diagram, instrument layout and filament-transformer details are shown to the upper right on this page. Old laminations from audio transformers may be used to assemble the core, but a specified cross section is necessary for a certain number of primary turns, in this case 1,320.



(To Be Continued)

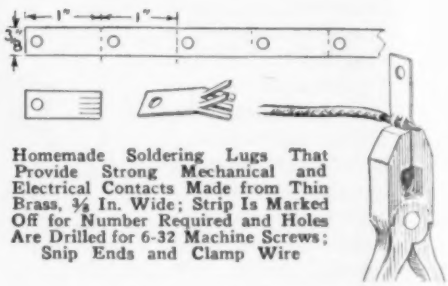
Improving the Radio Ground

A water pipe leading into the earth is the ideal ground connection, but this is not always available in rural districts. An equivalent ground may be obtained by driving a length of gas pipe as deep into the earth as possible and sinking a large tile around it. A hole, about 8 in. deep, is dug for the tile and earth is filled in around the pipe to leave a cup into which water can be poured from time to time. A ground of this description is especially useful in dry, sandy country, where it is almost impossible to provide a good ground in any other way.—F. W. Bentley, Jr., Missouri Valley, Iowa.

Dialing for New Stations

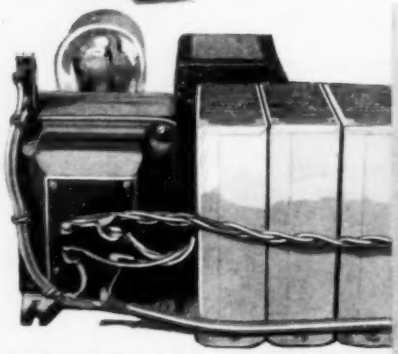
Older types of receivers had their dials marked in degrees and gave the listener very little information as to where to tune in a station. Newspapers usually list the stations by name and give the wavelength in meters, the frequency in kilocycles or both. This is of little help to the beginner unless he understands the relation between kilocycles and meters. First it should be remembered that as the frequency or number of kilocycles increases, the wavelength decreases. Suppose a station listed as operating on 1,070 kilocycles is desired but you have no means of knowing where this will be on your dial. If, however, you have tuned in a station with a frequency of 1,050 kilocycles and another on a frequency of 1,090, the station you want, if within the range of the set, will be tuned in at a point midway between these two settings. To reduce kilocycles to meters, divide 300,000 by the station frequency in kilocycles, likewise, dividing 300,000 by the wavelength in meters gives the frequency in kilocycles.

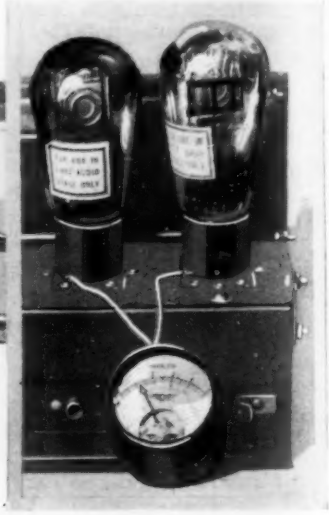
Simplified to your Radio

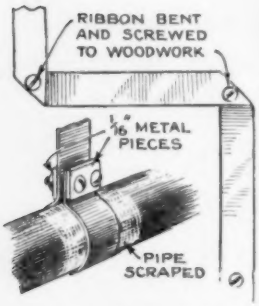


Homemade Soldering Lugs That Provide Strong Mechanical and Electrical Contacts Made from Thin Brass, ¾ In. Wide; Strip Is Marked Off for Number Required and Holes Are Drilled for 6-32 Machine Screws; Snip Ends and Clamp Wire

Small S.P.D.T. Switch May Be Mounted at Any Convenient Point on Console for Quick Shifting of Antenna to "Short" or "Long" Antenna Posts on Chassis; Lead-In Wire Is Connected to Switch Lever; Below, Homemade Ground Strip and Clamp of Copper Ribbon

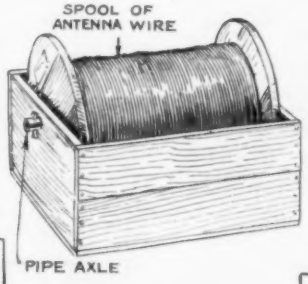




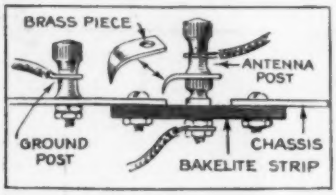


When Heavy Stranded Wire of Sufficient Current-Carrying Capacity Is Not Available for A.C. Tube-Filament Leads to Heater Transformers, Several Lengths of Smaller Stranded Wire May Be Twisted or Braided Together as Shown; Heavy Filament Leads Are Necessary, a Point Often Overlooked by Experimenters.

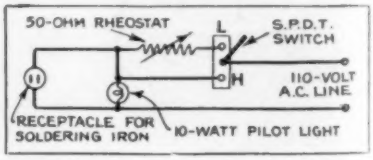
Right, a Large Coil of Antenna Wire, Mounted in a Box as Shown, Is Portable, and the Radio Service Man Finds This Method Saves Both Time and Money; Below, Simple Lightning Gap for Any Receiver; Gap Is Adjusted to Thickness of a Dime from Chassis; Battery Nut Supplies the Spacer



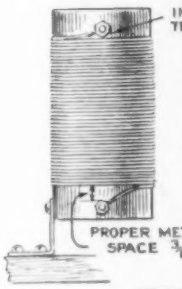
Unmatched Tubes in Push-Pull Amplifiers Cause Lack of Pep, Distortion, Hum and Poor Tone; to Check Tubes, Wrap Stranded Wire around the Plate Prong of Each Tube and Replace Tubes in Sockets; Voltmeter Is Connected as Shown; a Reading of More Than 1 Volt Indicates a New Tube Should Be Put In to Match; if Meter Reads Backward, Reverse the Leads



Right, Heat Control for Electric Soldering Iron Prevents Excessive Heating; Switch at H Is for Quick Heating and at L for Long-Period Control

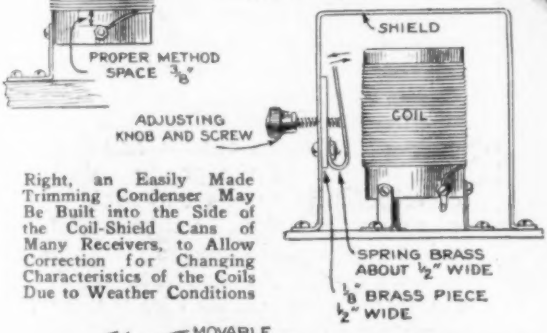


Answers Problems

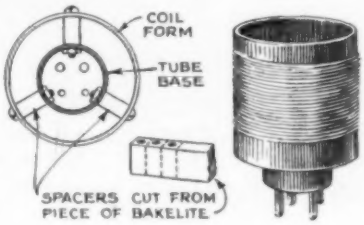


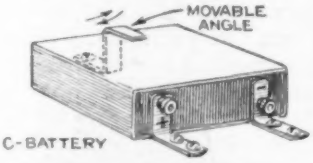
Left, When Mounting R.F. Chokes in Amateur Transmitters, Care Should Be Taken to Keep Terminals, Brackets or Other Metal Parts at Least ⅜ In. Away from the Coil

Holes Accidentally Punched in Speaker Cones May Be Patched with Tape or Gummed Paper; Apply the Patch to Both Sides of the Cone; Below, a Tube-Base Mounting Can Be Used for Larger Coils by Inserting Spacers as Shown

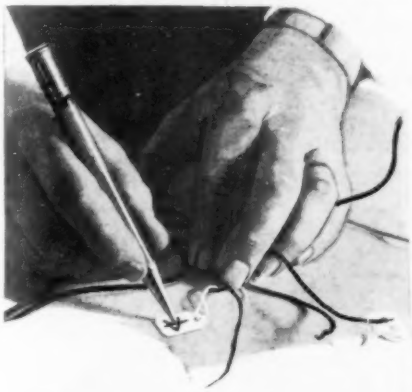


Right, an Easily Made Trimming Condenser May Be Built into the Side of the Coil-Shield Cans of Many Receivers, to Allow Correction for Changing Characteristics of the Coils Due to Weather Conditions

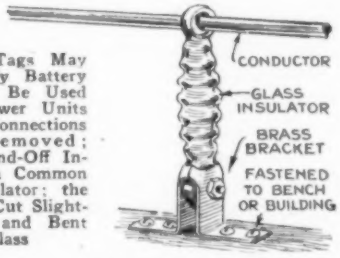




Left, Brackets for Mounting C-Batteries in Portable Receivers or Testing Apparatus; These Brackets Hold the Battery Securely and the Movable Angle Provides Easy Means for Renewal



Left, Small Price Tags May Be Used to Identify Battery Leads, and Should Be Used When Servicing Power Units or Sets Where Connections Are Temporarily Removed; Right, a Sturdy Stand-Off Insulator Made from a Common Glass Antenna Insulator; the Metal Brackets Are Cut Slightly Larger at Top and Bent around the Glass



Right, Chalk or Engravers' Wax May Be Used to Brighten Letters on Engraved Panels; the Old Filler Is First Removed with a Large Needle and the Panel Sponged Clean; the Engraved Surface Should Be Left Damp When the New Filler Is Applied; Rub In and Allow the Filler to Dry before Cleaning the Panel

Completely Assembled Set Showing Power Unit at Rear, and Band Filter with Trimmers Indicated

Unit Construction Feature of Custom Set

Wired and tested units enable the custom-set builder to assemble a de-luxe receiver in about three hours. This set employs nine tubes including four type-24 screen grids, one 27, two 45's, one 80 full-wave rectifier, and a voltage-regulator tube. Battery-operated models are also available. The "HiQ" circuit employs a three-stage pre-selecting band-filter unit and a three-stage screen-grid amplifier unit. These consist of the necessary coils and ganged condensers with adjustable trimmers, as indicated in the insert photo. Each unit is thoroughly shielded in a sealed copper can. Linear power detection, employing the screen-grid tube with automatic bias, eliminates all possibility of detector overloading. The new audio-frequency system consists of a resistance-coupled first stage and a push-pull output stage, using 45-type tubes. A local switch permits smooth, noiseless adjustment.

How to Shield the Receiver

Recent laboratory developments have brought out several points that should be observed in shielding radio circuits for greatest efficiency. The metal shield which incases the coil of a tuned circuit absorbs a small portion of energy from that circuit, causing a current to flow in the metal of the shield. It is therefore advisable to use a metal shield which will have as low a resistance as possible. Copper is considered the best material, within the means of the average experimenter, with brass and aluminum as substitutes. As the shield carries current from the tuned circuit which it houses, it should not be used to carry other currents. For example, the shield and chassis should not be employed to carry the negative side of the filament or plate current, for the purpose of connecting the load to one point of the metal chassis, and the negative terminal of the power unit at another point, in an effort to avoid the use of connecting wires. Neither should the shield or chassis be used to form part of a tuned circuit. All apparatus should be connected with insulated leads, and where wires pass through the shield, the holes should be as small as possible. Whether the shields are grounded or not, may be best determined by experiment. If grounding is advisable, they may be grounded at some convenient point using a heavy low-resistance conductor for the connection. All joints in shield cases should be soldered, if possible, making an independent unit of the shield.

Hand Microphone for Home Recording

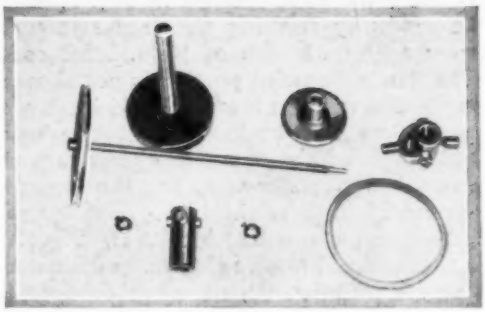
A hand microphone is available for home recording and amateur broadcasting. It may be carried in the pocket. Despite its small size it is said to be sturdily constructed and to reproduce throughout the entire musical scale.

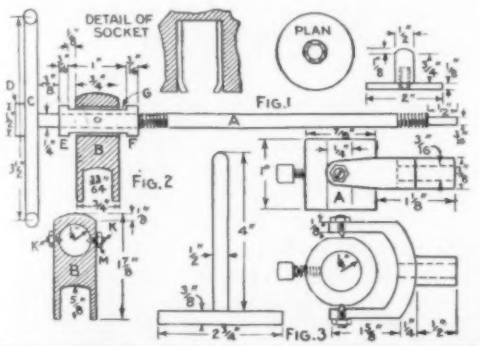
Recording Your Own Records At Home

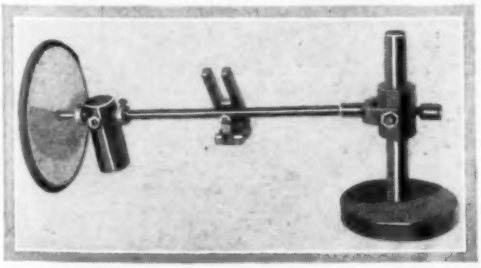
by Herbert McKay Part I

TO MAKE your own records is an interesting pastime, and many experimenters are obtaining excellent results, especially when modern methods of electrical recording are employed and the records reproduced through a good audio amplifier.

The recording outfit is easy to build, particularly if an old cylinder phonograph is available from which the lead screw can be salvaged. The mechanical parts of the device consist of a friction clamp with bearing which serves to hold the record blank tightly against the turntable to prevent slipping; a lead-screw support which rests upon the clamp, and a screw of about 30 threads to the inch and seven or eight inches long. A split nut threaded for this screw, a cutter clamp and a stationary support for the lead screw are also required. Motive power is supplied by a wheel fastened to the inner end of the lead screw and tired with a rubber belt made for use in a vacuum cleaner. The separate parts and the assembled tracking device are shown in the photos.







In addition to this device, the following accessories will be needed: a microphone, a good amplifier, a microphone-control unit to be described, and a good-quality phonograph pick-up fitted with a diamond or carborundum point. It is assumed that an electrical phonograph or combination radio-phonograph is available.

The tracker, which provides the proper motion for the cutting head, is diagrammed in detail, and can be made by your local machinist at small cost if the proper tools are not at hand.

The record clamp, for the center pin on the turntable, is detailed at the right in Fig. 1. An $^{11}/_{32}$-in. hole is drilled in the center of the post, from below, to take a ½-in. length of brass tube the outside diameter of which is $^{11}/_{32}$ in. and the inside $^{9}/_{32}$ in. This brass tube is split into 60-degree sectors at one end, as shown in the plan, and inserted into the drilled hole as shown in the sectional diagram at the left. The other end of the tube is then brazed into the bottom of the hole. Three alternate blades of this split tube are forced inward at the base with a small

Tracker Device with Cutting Head Installed for Making Record

screwdriver, to form binding springs that grip the center post on the turntable.

The drive unit, detailed in Fig. 2, may be made by forming the lead screw A from an 8-in. length of ¼-in. brass rod. The whole threaded portion is not shown in the diagram but it extends 5½ in. Two inches are left unthreaded at one end and ½ in. of the opposite end is turned down to a diameter of 7/16 in.; the threads are cut 30 to 48 to the inch.

The screw-support block, B, Fig. 2, is made from brass rod, ¾ in. in diameter and 1⅞ in. long, with the top domed ⅛ in. The ½-in. center hole is located ¾ in. from the extreme top. The rod is then turned 90 degrees and a hole is drilled through it at the same height for ⅛-in. setscrews. Two setscrews, ⅛ by ¼ in., are made and the ends are turned to a true 60-degree bearing point. These are screwed into the holes near the top of the support and locknuts provided.

A bearing indicated at G is made from a 1-in. length of brass tubing, having an outside diameter of ⅜ in. and inside ¼ in. Bearing points are spotted about 1/64 in. deep in the center of this tubular bearing at opposite sides. The bearing is placed in the large hole at the top of the support and the setscrews tightened into the spotted holes until the tubular bearing will rock freely without any other movement. The pulley C is turned from ¼-in. brass or aluminum with a round groove in the edge, as indicated. It is drilled for a ⅜-in. press-fit brass bushing, which is reamed to make a tight fit for the long unthreaded end of the lead screw. The bushing should be reamed carefully or the lead screw will not turn true when the pulley is attached. Two stop collars, indicated at E and F, with ¼-in. holes and setscrews, complete this unit. The setscrews prevent lateral motion, but should not bind the rod in the bearing.

The support for the lead screw is shown in Fig. 3, the base being made of brass or cast in lead. A steel post, ½ in. in diameter and 4 in. high, is set in this base. A sliding collar, ⅞ in. in diameter and 1 in. long, is made for the post, and a hole is drilled in the center of the collar for a 7/16-in. setscrew. The collar is flattened on each side, at a point 90 degrees away from the setscrew, to take the yoke shown at the right. Pointed setscrews are then used to hold the yoke in position in the same manner as described for the tubular bushing for the lead screw. The arm extending from the yoke is 5/16 in. in diameter and ½ in. long. A 7/16-in. hole

Complete Recorder Applied to an Electric Phonograph

is drilled clear through this arm, to take the small end of the lead screw.

(To Be Continued)

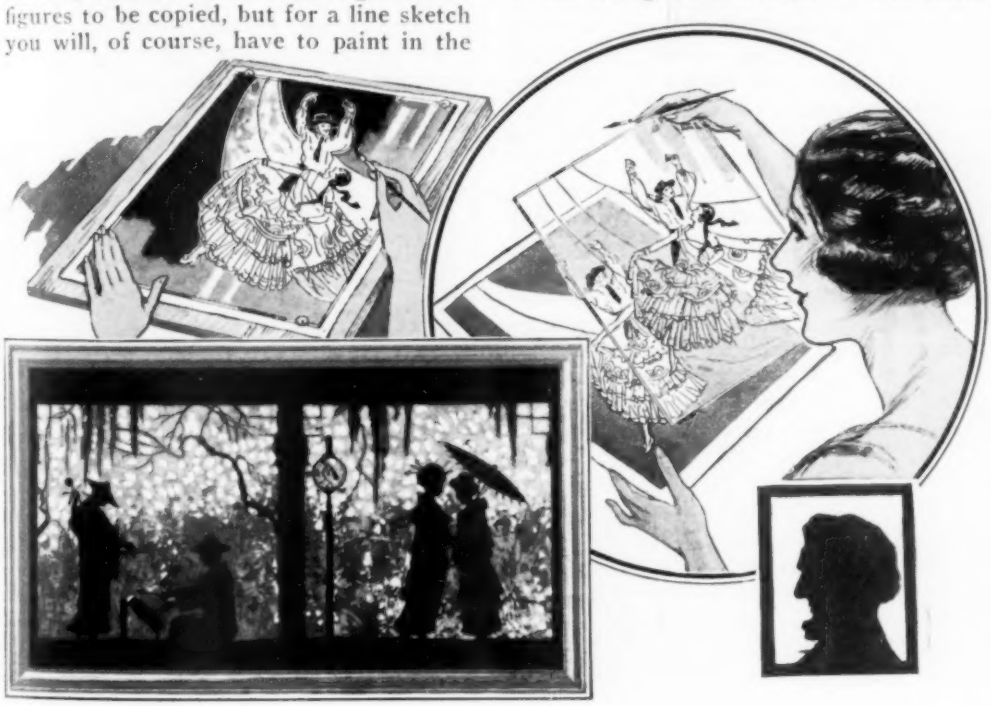
Set Noises Traced to Light Bulbs

Interference in a.c. receivers has been traced to old light bulbs, which cause a variety of buzzing and clicking sounds. The defective bulbs may be easily found during the daylight hours. The receiver is turned on and the volume control placed at maximum on a quiet point near the center of the dial. One person should remain near the receiver while another goes about the house turning on one light bulb at a time. As each bulb is lighted it should be shaken and tapped gently and the response checked at the loud speaker. —H. A. Wilson, Greenville, Ohio.

¶For further information on any radio construction article write to the radio department; this service is free.

Gay Pictures and Silhouettes on Glass

ATTRACTIVE silhouettes or plain profiles can be made with some ordinary paint, common window glass and a little tinfoil. First choose a subject. You may use a large profile photograph or pictures from magazines. Incidentally, the pictures shown here were obtained from this source. The next step is to obtain a piece of window glass, as large as, or a little larger than, the picture to be copied. The glass should be clear and free from any blemishes. Clean it thoroughly and place over the picture. Then, with a fine pen or camel's-hair brush, outline the figures with a good brand of ordinary black paint. If only a profile is desired, outline the extreme edges of the figures to be copied, but for a line sketch you will, of course, have to paint in the lines of the clothing on the figures. A completed sketch of this sort is shown in the right-hand detail below, the glass plate being held up to show the print underneath. With a plain profile, the next step after inking in the outline is to completely fill in the entire figure in black. The background is then daubed in spots with various colored paints, to give a mottled appearance. To do this, use a tuft of cotton wrapped in a piece of silk, which is dipped in the paints, taking care not to apply the paint too thickly. It should be thin in spots so that an additional background, perhaps of tinfoil, will show through. With a line sketch, most of the background is filled in with black



Two Suggestions That Lend Themselves Admirably to Use for Line Pictures and Silhouettes Backed with Tinfoil

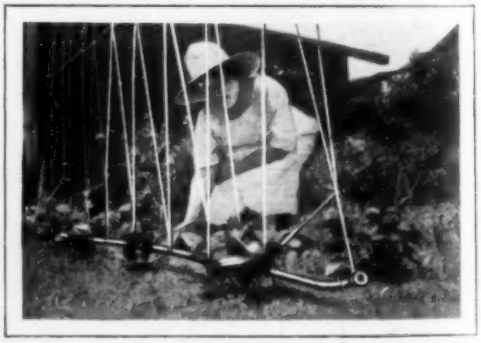
as in upper left-hand detail, page 127. Leave a space of clear glass, about ⅛ in. wide, between the outlined figure and the background so that a bright background will show through. Cheeks, eyes, lips and skin are then tinted if desired. In doing this, remember to paint cheeks, eyes and lips first, and then apply the flesh tint over these colors. Ribbons, hats, ornaments and designs of clothing may be lightly tinted with gay colors if you wish to add life to the picture. Now comes the final step. Place the glass on a flat surface with the painted side up. Over the entire back, place a large sheet of tinfoil, which can be purchased at most stationery stores or obtained from photographers who receive great quantities of it around films. The latter kind is backed with heavy red paper and does not tear easily. After placing it over the painted side of the glass, stick it down lightly at the four corners with paste, as shown. The tinfoil forms a secondary background, which shines through the mottled paint, producing a beautiful effect. The silhouette can then be framed and backed with cardboard. A few excellent examples of what can be done along these lines are shown in the illustrations.

Trolley Swing Helps Child Walk

A wire trolley, suspended across the room to support a baby swing of the type designed to hang in a doorway, will be of great help in assisting the child to walk. The ends of the wire are run through screweyes driven into window or door casings, and, if desired, a turnbuckle is provided to take up the "slack" in the wire from time to time. Slip a 1-in. grooved pulley over the wire and attach the rope holding the swing to the edge of the pulley. The swing should be arranged at such a height above the floor that the baby can propel it along the wire with its feet.

Vines Tied to Pipe Save Stakes

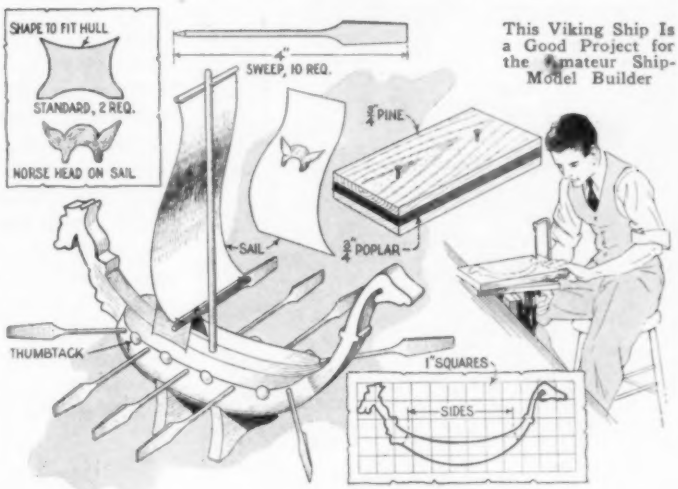
For a vine trellis, a pipe suspended from a number of cords, as shown in the photo, will be found a much quicker installation than driving stakes into the ground. The upper ends of the cords are tied to a wire suspended between two posts or fences. If desired, water may be conducted to the plants through the pipe to which the cords are attached, by connecting it to a hose, perforating the pipe with small holes to give the effect of a sprinkler. —C. C. Wagner, Los Angeles, Calif.



Vine Trellis Made by Suspending Pipe from Cords Attached to a Horizontal Wire

¶Commutators of small electric motors can be readily cleaned by holding an ordinary rubber eraser against the commutator while the motor is running.

ORNAMENTAL VIKING SHIP CUT OUT WITH FRETSAW



This Viking Ship Is a Good Project for the Amateur Ship-Model Builder

After building one of these viking ships, you can make a dozen more for your friends in a very short time. The biggest part of the job is to cut out the hull, which can be done by hand with an ordinary fretsaw, or still more quickly with a bandsaw. Lay off 1-in. squares on a 12-in. sheet of paper and draw the template for the hull, following the cross-hatched detail given here. Get two pieces of ¾-in. white pine and one piece of poplar or other hardwood, and nail them together temporarily with the hardwood piece in the center. Then saw out the bottom curve of the hull, after which the pieces are separated and the sawing of the center-piece completed. The three pieces are then glued together in their respective positions, and the hull is rounded to shape and finished, using a chisel and a sanding block. Straight-grained white pine is also used for making the sweeps, the ends of which are fitted into holes drilled ⅜ in. deep into the sides of the hull, at various angles as indicated. Thumbtacks are pressed into the side of the hull near the top edge to represent shields. A 3/16-in. mast, about 7½ in. high, has been found most appropriate for this-size hull, being sunk into the deck and glued. After cuttings the sail from muslin, it can be stiffened with shellac, bellying it before the shellac has dried. If desired, a Norse headgear can be painted on the sail in contrasting color. A small tent, also made of muslin, and stretched over a wire frame, is placed just ahead of the sail. To hold the hull, small standards, cut to fit its curvature, are glued on. The finish of the hull is largely a matter of personal taste, but the pores of the wood should, of course, be well filled and the surface well sanded down.

A Gluepot Made from Tin Cans

Two tin cans, one about 4 in. in diameter and having a tight-fitting lid, and the other about 2 in. in diameter, can be made into a serviceable gluepot. Cut a hole in the lid of the larger can and solder the smaller one into it, allowing the top of the latter to project far enough to hold a cover. The glue is melted in the smaller can, which should not touch the bottom of the larger one in order to prevent the glue from burning. A suitable handle, cut from a piece of sheet metal and bent to the shape shown, is then soldered to one side.

Red Ink Intensifies Photos

Photos that are under-exposed can readily be intensified by immersing them in a solution of red ink and water. Get a small tray, about 5 by 7 in. in size, fill it with water, and add 2 teaspoonfuls of the ink. Place the negative in the solution until it takes on a pinkish color; then remove it and allow to dry. If one immersion is not sufficient, repeat, remembering that the more the negative is intensified, the longer it will take to print it.

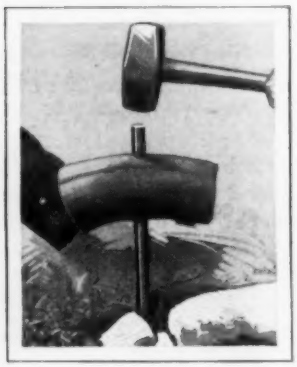
Two Kitchen Chairs Tied Together Form a Safe and Sturdy Chair for the Baby

How to Improvise a Safe Chair for the Baby

A comfortable baby chair can be improvised in a few moments from two kitchen chairs. Place one chair on top of the other as shown, and tie them together at the back. Put the baby's legs through at the front, first placing a cushion in the bottom of the inverted chair, and there will be no danger of falling out. Wads of cloth tied tightly on the ends of the legs of the inverted chair provide protection against bruises.

Rubber Guard Protects Hand When Holding Chisel

An 8-in. section of an old auto casing, with a hole punched in the center, furnishes a good guard for a chisel, especially when using a heavy hammer. Such a guard will protect the hand from being painfully bruised, if struck while holding the chisel.

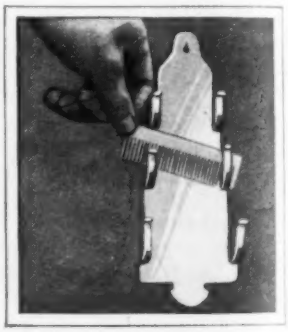


Earthworms Brought to Surface by Vibration

To get earthworms for fish bait, we use a much easier method than digging them out, which everyone knows is a rather laborious process, especially if there are only a few worms to be obtained. Two or three stakes are driven firmly into the soil and a piece of wood or pipe is slapped across the top of the stakes which will make the worms crawl out of the earth in a few minutes, after which it is a simple matter to pick them up. It has been found that "fiddling" in this way for 3 or 4 minutes will cause every worm to come up within a radius of 15 or 20 feet.—J. W. Gannon, Montgomery, Ala.

Comb Rack Cut from Tin Can

When in need of a comb rack for your camp or cottage, get an empty can and flatten it out to a single piece. Then cut it to the shape shown in the photo, with lugs on the sides which are bent outward to form hooks for holding the combs. The sharp edges of the metal should be filed or scraped off, and the ends of the hooks may be turned over as indicated.—Ormal I. Sprungman, Minneapolis, Minn.



A Repair for Corrugated Roofing

Holes in corrugated roofing can be repaired by applying patches of 14-oz. cotton duck, impregnated with a mixture consisting of a few pounds of melted asphalt and a few ounces of powdered graphite. Put the patches in the hot solution until they have been thoroughly saturated, keeping the mixture over a slow fire. Then remove the patches and press them down firmly over the holes in the roofing. Such a repair has been found highly satisfactory as it is waterproof and the asphalt will not melt, owing to the presence of the graphite.

How to Control the Bean Beetle

If your beans were eaten up last year by a yellowish-colored worm that chewed on the leaves until they had a lacy appearance, you were getting acquainted with the Mexican bean beetle, one of the worst garden pests known in the United States. Ordinary spray mixtures do not control this bug, but federal entomologists have found a poison that is very effective. It is magnesium arsenate, and the way to use it is to mix 5 level tablespoonfuls of the powder with 3 gal. of water. If you have a big garden and wish to make up a larger amount of the poison, use 1 lb. to 50 gal. of water. This solution must be sprayed thoroughly on the underside of the leaves.

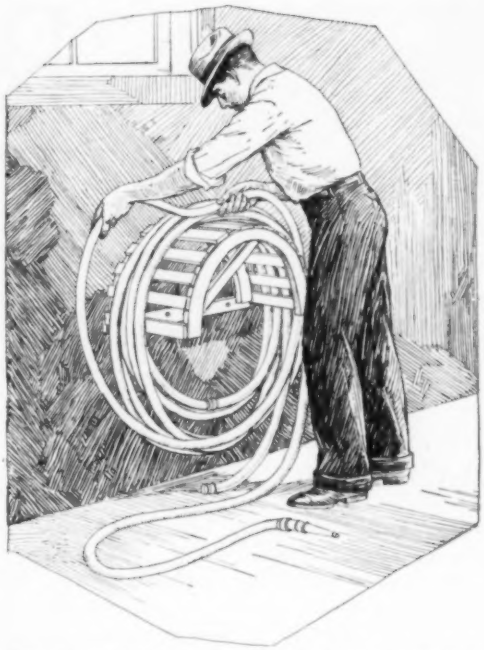
Food Cooler Made from Paper Box

An ordinary corrugated-paper box, saturated with water and set in a shady place with free air circulation, will serve as a satisfactory food cooler for the summer cottage or camp. The material takes up nearly four times its weight in water, thereby affording a plentiful supply for evaporation which cools the contents of the carton.

Canvas Hangar Shelters Boats

Stretched over curved rafters and lashed securely to the floor of a dock cut out to house one or more small boats, a large canvas tarpaulin forms a serviceable boathouse. The rafters are spaced from 2 to 4 ft. apart and are braced by a number of strips running lengthwise. When winter comes, the canvas is rolled up and stored away.

Huge Canvas Tarpaulin, Stretched over Curved Framework on the Dock, Forms an Excellent Boat Shelter



There Will Be No Kinks in Your Garden Hose if It Is Coiled on This Rack

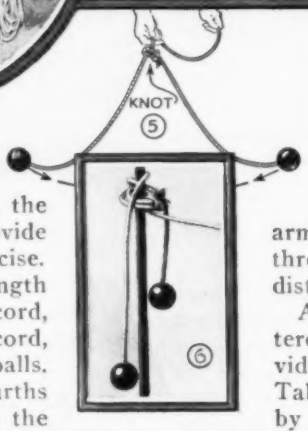
Garden Hose Protected from Kinks on Semicircular Rack

Proper care is the life of a hose, especially when it is stored in the basement or on the wall of the shop for long periods. A good rack for holding it, which will prevent it from kinking, can be made as follows: Cut two semicircular pieces from 1-in. material and nail a number of 12-in. sections of lath, or other light material, across the outer edge as shown. Fasten the rack to a suitable hanger mounted on the wall and wrap the hose over it as shown in the illustration.

Lock with Metal Plate Baffles Burglar with Skeleton Key

Doorlocks on garages and workshops that are easily opened with skeleton keys, can be made burglar-proof in the following way: Screw, rivet or solder a small piece of sheet metal over the keyhole on the inside of the door and file the end of the key to about half of its diameter. Then drill a hole in the sheet-metal plate to receive the filed end of the key. Ordinary keys will not fit a lock so prepared, and therefore cannot be used to open it.

REAL SPORT



WITH a pair of spinning balls at one end of a rope and you at the other, the bolas shown here will provide great sport and good exercise. To make one, get a 30-ft. length of No. 12 braided cotton cord, commonly known as sash cord, and two 2-in. sponge-rubber balls. Drill a hole about three-fourths through each ball, in which the rope will fit snugly, insert one end of a 33-in. length in one ball and drive a finishing nail through both ball and rope, as shown in Fig. 1, squeezing the nail in a vise so that both ends will go below the surface. Attach the second ball to one end of the other rope. Hold both ropes with the balls hanging down and form a loop in the longer rope, slip the end of the shorter one through and tie the knot shown in Fig. 2. When finished, the ball on the longer rope should be 3 in. below the other.

The simplest thing you can do with the bolas is to swing them around as in Fig. 4, and let fly at some target so that the balls will wrap the cord around it as in Fig. 6. On the pampas of South America, the hard-riding gauchos can upset a cow in a very neat manner with a somewhat similar outfit. If you wish to tangle more distant targets, make up a second bolas minus the long line, as shown in Fig. 3. With a good swing of the arm, you can send this sailing through the air for a considerable distance as in Fig. 14.

Although target work is interesting, it falls far short of providing the real sport with bolas. Take circle-swinging first. Start by placing the two balls on the ground, grasping the rope with the right hand just above the knot, as in Fig. 5. By suddenly lifting the balls, they will swing toward the center. If you swing your hand upward snappily, the balls will swing past center and continue around in large circles. By moving your right hand up and down with a jerky motion, the balls can be kept right on swinging, one toward the left, the other toward the right. (See Fig. 7.) To do this, of course, takes patient practice. Starting the ball going can also be done by the methods shown in Figs. 8 and 10, the latter being the easier. With the right hand hold the bolas at the knot and with your left hold one of the balls on one side at the level of your head. The free ball is set swinging from side to side like a pendulum, the

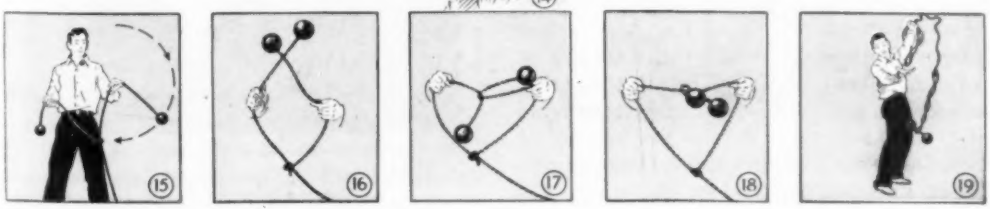
with BOLAS

arc of the swing gradually increasing until it approaches the point where a slight jerk will send the ball around in a circle, and at this point the second ball is thrown in the opposite direction. The right hand then takes up the short up-and-down movement, and the balls continue to sweep past each other. In Fig. 8, the two balls are similarly started at the bottom of the circle.

After circle-swinging has been mastered, swinging in an overhead plane, Fig. 9, may be tackled, or you can proceed with the movements shown in Figs. 11, 12 and 13. Start by swinging the balls in individual circles, Fig. 12. Then the hands are gradually worked toward the center of the rope, Fig. 11, after which the right hand takes complete control. While the balls are swinging through the circle, the left hand is suddenly thrust through the crossing made by the two ropes, with the result that they wrap themselves in uniform coils around the wrist. After the balls come to rest, the left hand is moved with a snappy up-and-down motion, and the balls unwind until swinging normally again, as shown in Fig. 13.

For something entirely different, try the little knot-tying stunt shown in Figs. 15, 16, 17 and 18. One ball is held motionless in the right hand while the other is swung in a circle with the left. As the latter comes to the top of a circle, the right-hand ball is suddenly whipped across it, so that the two ropes wrap around each other to form the knot, shown in Figs. 17 and 18. After tying the knot with a swinging toss of the arm, the two balls should be pulled back as shown in Fig. 19, so that the rope can be caught with the right hand. When these movements can be performed in a flash, the knot is apparently tied by a single movement of throwing the bolas.

You can readily see how the different effects shown in Figs. 11 to 19 can be effectively combined to form an interesting performance. You start the bolas swinging, transfer the rope to your left wrist, off the wrist and back to the position shown in Fig. 12, then into the throw, ending with the jerk that reveals the knot tied in the two strands of rope. Although this procedure may not appear so striking in cold print, just try it and find out that it is real sport.



USING THE TYPEWRITER OUTDOORS AND IN A CAR

Combination Tripod and Window-Ledge Typewriter Holder

Those who have to use a typewriter outdoors or in the car, will find the illustrated holder of great convenience. It is a combination outfit that can be used either on a camera tripod or be hung directly in front of the user on the window and windshield ledge of the car. Take a large-size breadboard, drill a hole in the center and provide a tapped sleeve to take the screw of the tripod. Three 12-in. lengths of 1/16 by 1½-in. flat iron are bent to form hooks and screwed to the board to permit attachment to the window ledge, the exact shape of the hooks being determined by the particular type of car you have. It is a good idea to sew a heavy cloth sleeve around the hooks to avoid marring the finish. To eliminate any tendency of the board to vibrate excessively, a strap can be slipped through a hole cut or drilled in the board and tied to the steering column, so that it will not interfere with handling the gear shift or emergency-brake lever. The construction just described applies to a small portable typewriter, but can readily be adapted for a heavier machine.

Mirror Aids Taking Snapshots in Shady Places

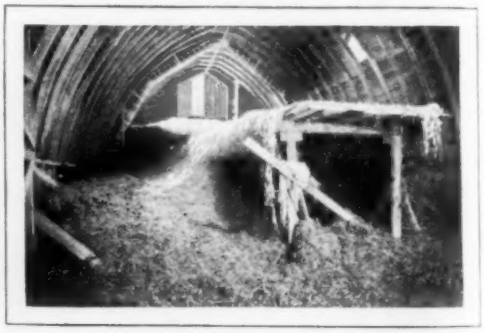
Clear snapshots can be taken of objects in shady places by using a mirror to reflect the sun's rays on the object. Have one of your friends hold the mirror. A little experimenting will quickly determine the correct distance the mirror should be located from the object in order to provide sufficient illumination.—R. C. Radcliffe, Laurel, Md.

This Pocket Blower Starts Your Campfire Quickly

Here is a pocket blower for starting a campfire quickly. It is especially useful during wet weather when the fire "smudges." The blower consists of a 6-in. piece of ¼-in. brass tubing and a 2-ft. rubber hose. Flatten one end of the tubing to form a narrow slit and insert the other end into the hose. Place the flattened end of the tubing close to the fire and blow into the hose. A candle will be found helpful in lighting fires when the wood and leaves are damp, as it can be held against them until ignited. Carbide is also handy for starting fires in wet weather.

Hay Packing Prevented by Platform

In barns having considerable space between the fork rail and the mow floor, a platform, about 8 ft. wide and 12 ft. high, will break the fall of the hay. This prevents it from packing, which spoils the hay and sometimes causes fire.



Fire Hazard Resulting from Packed Hay Is Avoided by Using a Platform in the Loft

Sharpening the Lawnmower

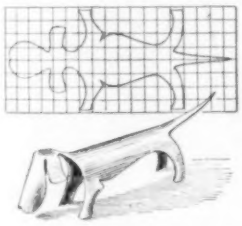
Lawnmowers can be sharpened easily with a dime's worth of emery dust mixed in enough lubricating oil to make a paste. The drivewheels are removed, and the cogwheels that revolve the blades are reversed in position so that the blades will run backward. The blades are set against the cutter bar and emery paste applied. They are then run backward for awhile until sharp. When finished, the cogwheels are again placed in their proper position. —R. Childs Smith, Medford, New York.

Rose Pest Is Easily Cured

Tiny insects known as "thrips," which suck the juices from rose plants often causing them to die, can be controlled by destroying all of the old blossoms and spraying the buds with a solution consisting of 1 oz. nicotine sulphate and 6 gal. of water. Also dissolve 1 lb. laundry soap flakes in the solution.

Sheet-Brass Dachshund Formed with Shears and Pliers

Interesting knickknacks representing small animals can be cut from thin sheet brass and bent to shape with the fingers or with the aid of a pair of pliers. An example of this work is the form of a dachshund, the pattern of which is shown in the drawing, each square representing ¼ in. After cutting this out, bend the body over in the center and turn the head and ears down, while the tail is given an upward sweep. After polishing the brass, a coat of transparent metal lacquer may be applied.



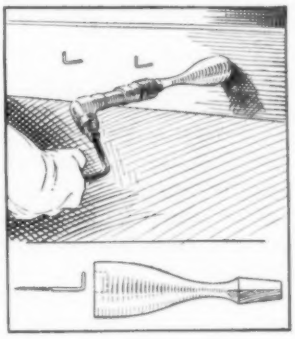
Steel Articles Lost under Water Recovered with Magnet

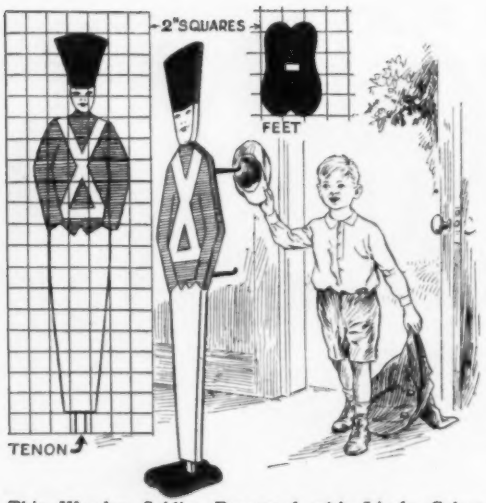
Magnets taken from an old telephone ringer or a Ford magneto can be used to recover iron and steel articles lost under water. Obtain two wooden strips, 7 by 1 by 1 in., and cut four grooves to hold the magnets when clamped over them, as shown in upper detail, the strips being held together with a screw at each end. A screweye is driven into the upper strip in the center for attaching a rope. In use, the battery of magnets is dropped into the water and dragged over the bottom, where it will pick up all iron and steel objects within its capacity. Valuable fishing poles can be recovered in this way.—Frank W. Howe, Milwaukee, Wis.

Battery of Magnets Dragged along the Bottom, Recovers Lost Iron and Steel Articles

Driving L-Hooks with a Brace

Where a number of L-hooks must be driven, the illustrated attachment for an ordinary brace will be found a timesaver. Cut the end of a broomstick to fit in the chuck of a brace, as shown in the lower detail, and a notch in the other end to fit the hook.—H. I. Hughes, Portland, Ore.





This Wooden Soldier Decorated with Lively Colors Makes a Good Clothes Hanger for Children

Child's Clothes Hanger Resembles Soldier

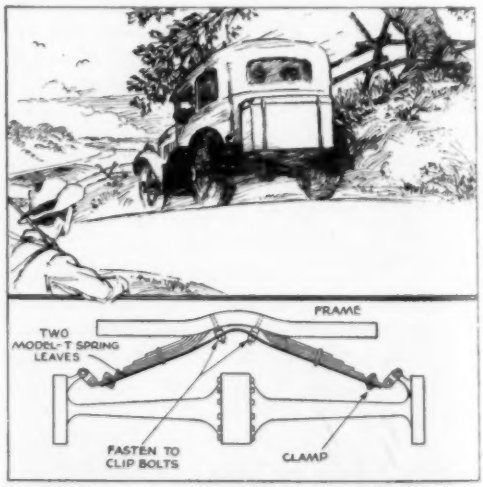
This coat hanger for the small members of the family will help teach them to dispose their clothes in an orderly manner. On a piece of paper, about 14 by 40 in. in size, lay off 2-in. squares, and lay out the form of a soldier as shown in the crosshatched section. As there are no small curves in this design an ordinary keyhole saw can be used to cut out the figure, although a bandsaw, if available, will save time. Hardwood, 1 in. thick, is used for the body, while the feet, shown in the upper detail, are cut from 2-in. stock. The tenon at the lower end of the legs should fit tightly in a mortise cut in the feet, and is then glued in place. Any attractive color can be used to decorate this clothes hanger in true military fashion, after which hooks are screwed to the back as indicated.

A Cheap Camera Portrait Lens

Those who have no portrait or telephoto lens on hand will find an ordinary spectacle glass satisfactory for the purpose. Go to an optometrist and ask him to select one of suitable strength, which can be determined by holding it in front of the camera lens and using a piece of ground glass against the film roller after the camera back has been removed. A round pill box, with the bottom removed, provides a good mounting for such a lens, the inside of the box being lined with black velvet so that it fits snugly over the camera lens.

Extra Spring Leaves Are Needed to Support Heavy Trunk

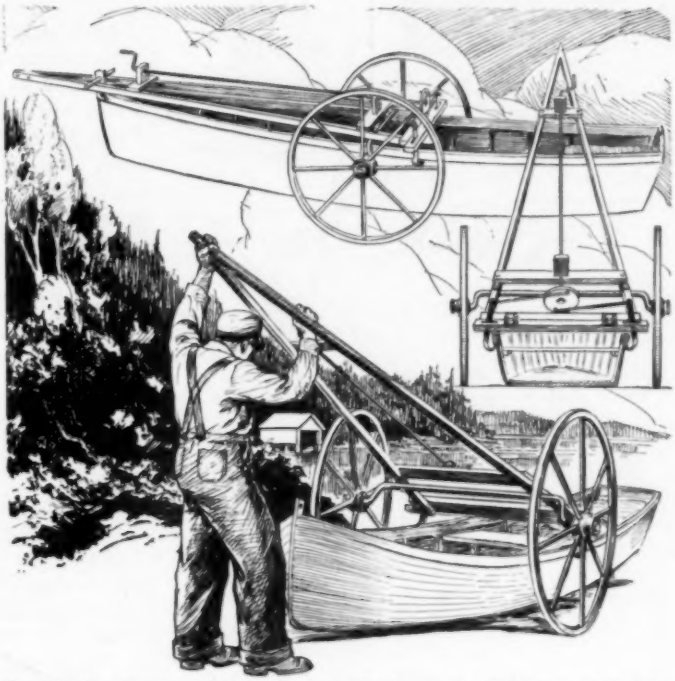
Heavy trunks carried on light cars are a likely source of spring breakage, and frequently cause the spring to "bottom." Trouble can be avoided by installing extra spring leaves. On a model-A Ford it was found quite easy to add two leaves taken from a model-T. The second longest leaf and the one having shackles fastened to the ends were used. They were bolted together in the center. After jacking up the body to relieve the spring of the weight, the extra leaves were inserted between the four bolts that hold the spring to the frame at the center. Shackles were applied after the ends of the longer leaf had been forced against the model-A spring. These were made of 1 by ¼-in. flat iron, with 7/16-in. holes drilled 2¾ in. apart, to take ⅜-in. bolts, 1½ in. long. The ends of the extra leaves fit snugly against the turned model-A spring assembly, preventing sideplay.—Charles D. Jarrett, Fillmore, Calif.



Two Extra Leaves Strengthen the Rear Spring of Model-A Ford to Support Heavy Trunk

¶When acid or rosin-core solder is not at hand, a good substitute can be made by cutting ordinary wire solder into 3-in. lengths and dipping them into melted rosin.

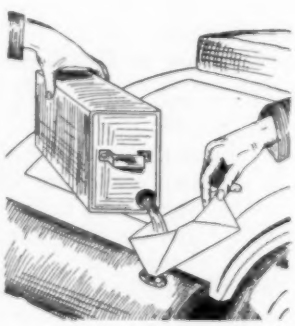
COMBINED HOIST AND CART TRANSPORTS ROWBOAT



Combination Rowboat Hoist and Cart Eliminates the Hard Job of Hauling It from Place to Place

It is usually quite a job to haul rowboats from a lake to the shed where they are kept over the winter or to take them from place to place. This difficulty can be eliminated by using the specially built cart shown in the drawing. It is not a trailer although it can be used as such, but a combination hoist and cart, by means of which the boat is picked up between two clamps and raised from the ground by pulling the frame down at the front, the frame acting as a lever pivoted on the axle. Two light wagon or buggy wheels are used, and the axle is offset at both ends so that the central portion forms a 6-in. crank. The frame is made up of 2 by 4-in. stock, in a V-shape, the narrow end fitting over the bow of the boat. In this particular case, the stem of the boat extended far enough to project above the frame when the latter was brought down against the rail, and a hole was provided in the end of the stem to allow the insertion of a peg or pin, which crossed the frame members, holding them to the boat securely. The hooks can be tightened or loosened by a disk that can be rotated with a long crank, links being attached to pins on the disk as shown, and to the hooks. Turning the crank in one direction brings the hooks toward each other, and turning it in the opposite direction forces them apart. In this way, the hooks are adaptable to any boat of average dimensions. If desired, the front end of the frame can be fitted with a universal joint for attachment to a towing rig.

Paper Envelope Used as a Funnel

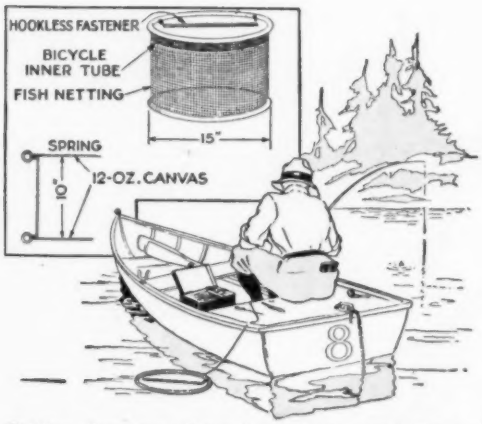


In an emergency you will find an ordinary paper envelope will serve the purpose of a funnel. Just tear off a corner at the lower edge of the envelope, hold it over the opening of the container to be filled, and pour the liquid into the envelope.—K. Manning, Lemoore, Calif.

Varnish Makes Putty Last Longer

Putty made of varnish and whiting will usually last longer than if made of oil and whiting. It is a good idea not to mix more than is needed as the varnish hardens and cannot be softened for use again.

Dry chloride of lime, scattered around and into rat holes, will keep the rats away.



Folding Container, Made from Netting and Piece of Inner Tube Holds Fish without Injuring Them

Collapsible Fish Tank

Many fishermen try to keep their fish alive until ready to start for home. Stringing them on a cord is injurious to the fish, and the usual method of passing a line through the gill and mouth actually drowns the fish. A much better way is to keep the fish in a floating tank as shown in the illustration. It consists of an oval canvas top and bottom, in the hems of which are fitted lengths of screen-door spring. These springs hold the tank in shape. The side wall consists of small-mesh fish netting. A slit in the top, fitted with a hookless fastener, serves as the opening. A bicycle tube, cut down to size and rejoined at the ends, gives the necessary buoyancy. If the inner valve is removed, the tube can be inflated with the mouth, so that it is not necessary to carry a pump along. When collapsed, the tank can be folded and carried in the pocket.

Evaporation of Cleaning Fluid Retarded with Tumbler

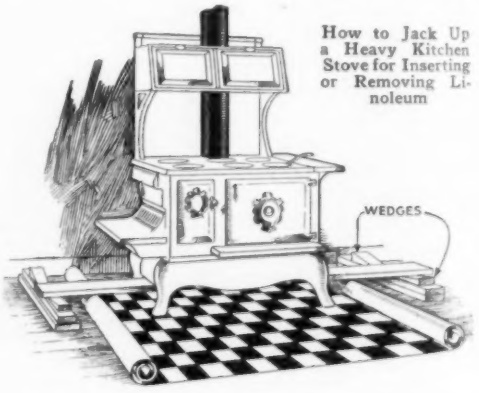
When using ether or chloroform to remove paint and varnish stains from garments having a delicate weave, the fluid usually evaporates so fast that the stains cannot be removed without vigorous rubbing, which is destructive to the fabric. The evaporation can be retarded by placing an inverted tumbler over the spot after applying the fluid. Allow sufficient time to permit effective chemical action before removing the glass, and then carefully sponge the spot to remove the stain. —G. E. Hendrickson, Argyle, Wis.

Missing Spark Plug Detected with Your Fingers

Spark plugs that are not firing are sometimes rather difficult to locate. An easy method is as follows: Allow the motor to run until thoroughly warm. The base of the plug not firing will be found to be much cooler than the others, when touched with a finger. This method also saves time as it is not necessary to use any tools.—Hugh Bersie, Wilmette, Ill.

Kitchen Stove Raised with Stout Plank and Wedges

It usually takes two or three men to lift a kitchen stove when taking up or putting down linoleum on the floor. By using blocks and wedges this can be done single-handed. Roll the linoleum from both ends toward the stove. Put a wide plank, of sufficient strength to hold the weight of the stove, under it. By placing wooden blocks under each end of the plank and driving wedges between the plank and blocks, the stove can easily be raised high enough to allow the linoleum to be inserted or pulled out.

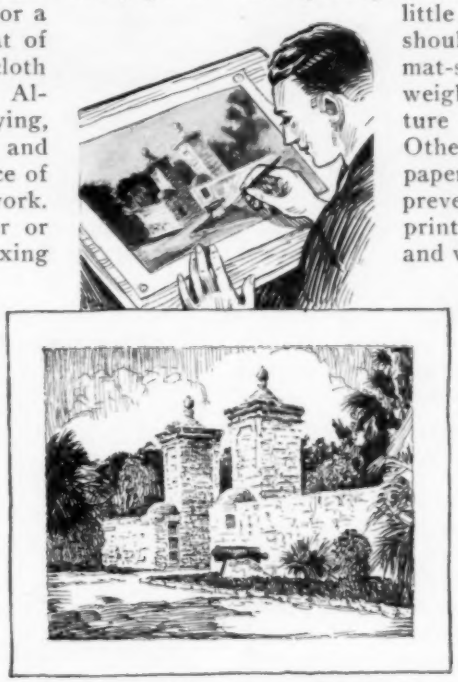


How to Jack Up a Heavy Kitchen Stove for Inserting or Removing Linoleum

How to Finish Woodturnings

Open-grained woods, such as oak or ash, require paste wood filler in order to obtain a smooth base for a finish, just as is the case with any furniture job. The filler is applied when the lathe is not turning. After the filler has become dull, the lathe should be started and the filler rubbed into the grain. It may be necessary to apply more than one coat in order

to get a smooth job, and in this case, you should wait several hours between coats. On close-grained woods, such as walnut and mahogany, gum and birch, paste filler is unnecessary. For a wax finish, apply a coat of floor wax with a soft cloth with the lathe at rest. Allow 10 minutes for drying, then start the lathe and polish by holding a piece of soft cloth against the work. After allowing an hour or two for drying, the waxing may be repeated until the desired luster is obtained. A French polish, which is very popular for lathe work, is given as follows: A fairly thin coat of shellac is applied on the object with a brush, slowly revolving the work by hand while doing so. After the shellac has set, sand lightly with No. 00 paper. Make a pad of soft-cotton cloth, preferably cheesecloth, and moisten with a little very thin shellac; also put a drop of ordinary machine oil, such as you use for the bearings of the lathe, on the pad. Start the lathe and bring the pad with a firm but light pressure against the work as it revolves. Renew the shellac and oil on the pad from time to time as may be required. If the shellac becomes gummy in spots on the work it can be made to flow out by putting a little more pressure on the pad so that the shellac gets hot. Too much oil will make a greasy finish, which will soon dull. Needless to say, the toolrest should be removed or turned well out of the way when polishing, to avoid having your fingers painfully burned or pinched.



Photos Can Be Made into Pen Drawings by a Simple Process of Tracing and Bleaching

Tar Oil Keeps Rats Away

Tar oil, sprayed into rat holes and runways, will keep rodents away. The oil can be thinned with benzine if necessary. This is effective as long as the odor lasts.

Making Pen Drawings from Photos

Photographic prints can be converted into good pen-and-ink drawings with a little practice. The photo should be printed on a dead mat-surface paper, of single weight if the finished picture is to be mounted. Otherwise, double-weight paper should be used to prevent curling. Fasten the print to a drawing board, and with a fine-pointed pen, such as map makers use, trace and shade the picture with waterproof India ink, working in the details in fine lines to make the print look as nearly like an etching as possible. After the ink is dry, the picture is bleached by using a solution of tincture of iodine, 1 part, and water, 5 parts. Soak the print in water for several minutes and then immerse it in the iodine solution for 3 or 4 minutes. It will then be stained almost black. Rinse it in water and place in an ordinary hypo-fixing solution for about 5 minutes, which causes the stain to disappear, leaving the inked image on a white background. Wash the picture for 15 minutes in running water, and dry. A light print is easier to ink and less difficult to bleach.

Rubber Protects Emery Wheels Packed in Toolkit

Small emery wheels are likely to be nicked and broken when packed with other tools in a kit. Cut off a section of old inner tube, about 4 in. wide, and stretch it over the wheel. The rubber will cover the face and part of the sides, and will protect the wheel from damage.

Stirring Rod Actuated by Windmill Helps to Drive Out Heat from Milk

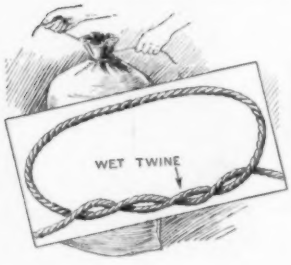
Windmill Attachment Stirs Milk in Cooling Tank

Agitating milk to remove the animal heat can be done by means of an easily improvised attachment on a windmill. The attachment consists merely of a walking beam pivoted to one of the cross members of the windmill frame and bolted loosely to the pump plunger at one end and to a stirring rod on the other, as shown in the illustration. The stirring rod consists of two pieces held together by means of a thumbscrew, so that the lower part can be removed.

Tent-Door Ties Replaced with Snaps

Bobbinet doors on umbrella tents are usually fastened to the walls with strips of tape. By replacing these with snaps, such as are used to fasten side curtains on open cars, the door can be shut more snugly, preventing the entry of gnats and mosquitoes.

Wet-String Knot Holds Tight



Knots tied with a wet string as shown will not come loose. It is wrapped around the mouth of the sack twice, after which the ends are twisted as indicated and pulled tight. Knots made in this way are so hard to remove that it is almost necessary to use a knife to cut the string.

Writing on Celluloid with Acetic Acid

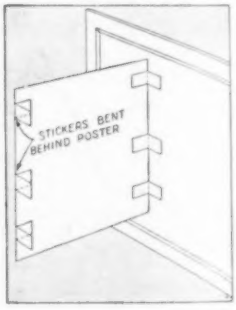
Draftsmen will find that anhydrous acetic acid is a good ink for writing on celluloid triangles and other articles of that material. The characters will appear dull on the glossy surface, and if color is wanted, tint the acid with ink of the desired color.

Developer Retarded by Sugar

Sugar, or molasses, has been found effective for slowing down the action of a wet-plate developer as it thickens the solution and retards the precipitation of the silver. The mixture is made up from 1 oz. of sugar, or 2 tablespoonfuls of molasses, and 16 oz. of developer.

How to Conceal Poster Stickers

When using stickers to attach posters to walls, etc., a neat job can be done if the stickers are concealed. A good way to do this is to apply the stickers to the back of the poster, along the edges, allowing about half to project. It is then an easy matter to fold them back, moisten the other side and press the poster against the wall.—James Goodman, Stockbridge, Mich.



Oilcloth Cures Slipping Rugs

Slipping rugs on polished floors can be made safe by sewing a piece of oilcloth, slightly smaller than the rug, to the underside. The finished side should be next to the floor to provide the necessary friction.

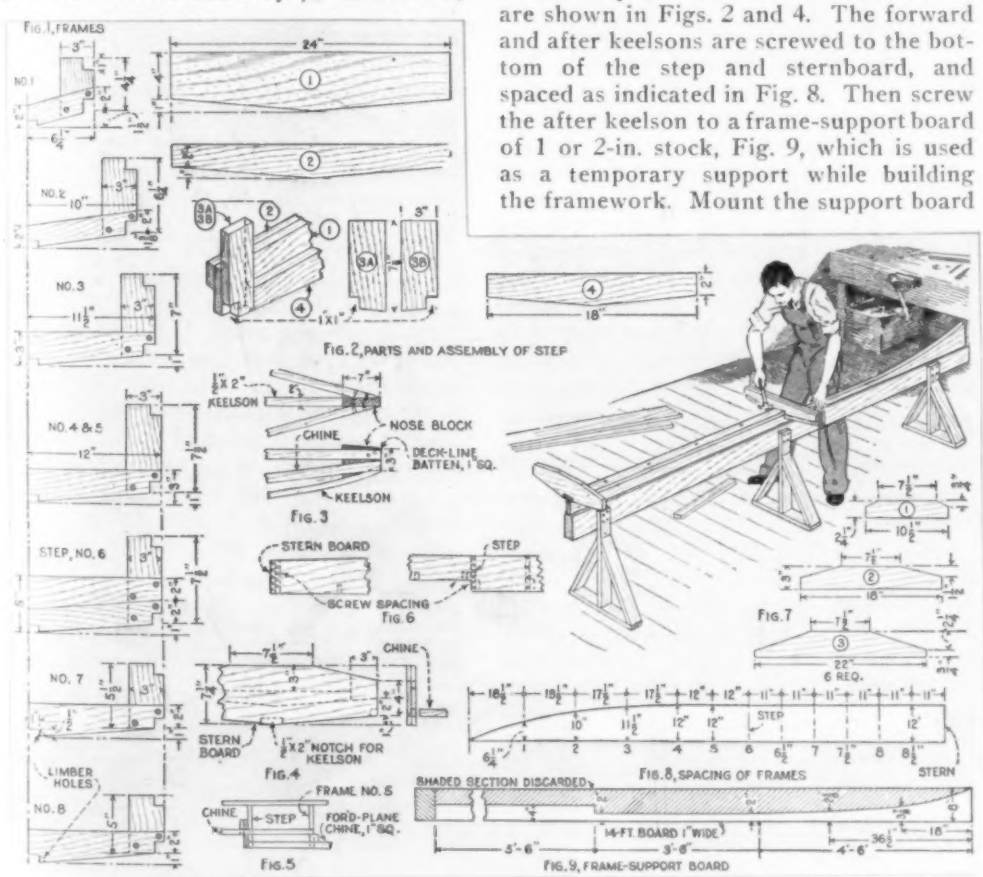
¶To cut clean threads in aluminum apply kerosene while threading.

While Skimming Lightly over Water at 40 Miles an Hour, "Aero-Boat," Which Is Equipped with a Powerful Racing Outboard, Displays Unusual Stability as a High-Speed Craft

PART I

BOTH in looks and appearance "Aero-Boat," a hydroplane of unusual design, has surpassed all expectations.

Build the pontoons first by cutting out the eight frames in Fig. 1, which shows half of them. Cut a recess, ½ in. deep, at the center for the 2 by ½-in. keelson, and 1-in. notches for the chine and deck-line battens. Use oak or poplar for these parts. Three intermediate frames, not shown in the drawing, are located between frames 6, 7 and 8, and are of the same size but have no uprights. Details of the step and sternboard construction are shown in Figs. 2 and 4. The forward and after keelsons are screwed to the bottom of the step and sternboard, and spaced as indicated in Fig. 8. Then screw the after keelson to a frame-support board of 1 or 2-in. stock, Fig. 9, which is used as a temporary support while building the framework. Mount the support board



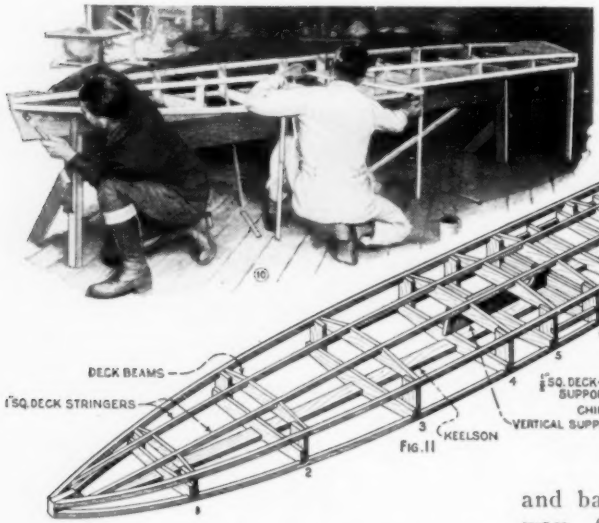


FIG. 11

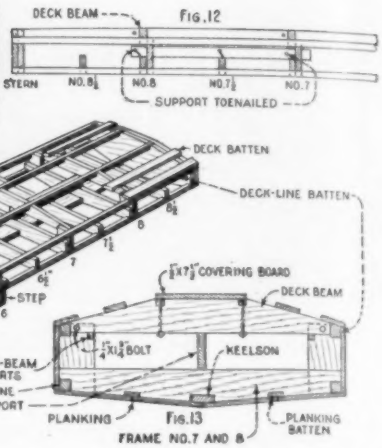


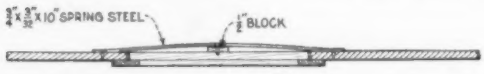
FIG. 12

FIG. 13
FRAME NO. 7 AND 8

on a 2-in. plank for rigidity, nailing the latter to suitable legs. A nose block of 2-in. stock, Fig. 3, is cut out to conform to the curve of the support board, and the forward keelson is screwed onto this block and then to the support board at 1-ft. intervals. The frames are then set in place, being sure to get them at right angles to the keelson when screwing on the chines and deckline battens, which is done next.

The after chine should not stop at the step but is continued past it and lapped into frame 5, as shown in Fig. 5. The deckline batten extends from the sternboard to the nose block, being mitered to fit the latter. No. 5 flat-head, brass screws, 2 in. long, are used to attach the chines and battens to the frames, and, by the way, flat-head brass screws are used throughout. Use a 14-ft. board of ½ by 8-in. red cedar for each side. Before screwing it on, place the support board on a perfectly level floor so that the frame can be straightened out level, preventing torsional twists, which would seriously interfere with the performance of the finished craft. Such leveling can be done by means of props set on the floor and temporarily nailed to some of the frames, as shown in Fig. 10, three pairs of props being sufficient.

Clamp one side plank in place so that a pencil mark can be made all around the outside of the chine and deckline batten, after which the plank is ripped about ¼ in. outside of this line to leave surplus stock for planing. The plank is not cut down close to the step or sternboard until after it has been screwed on, as a narrow margin would cause splitting when driving in the screws. This precaution is also followed with the rest of the planking.



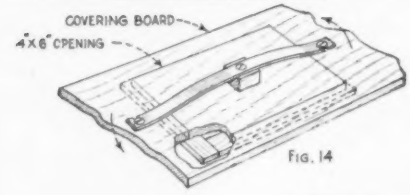


FIG. 14

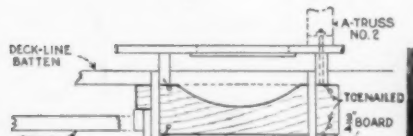
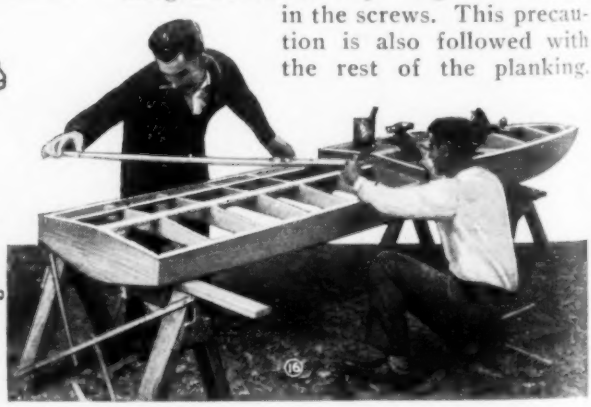
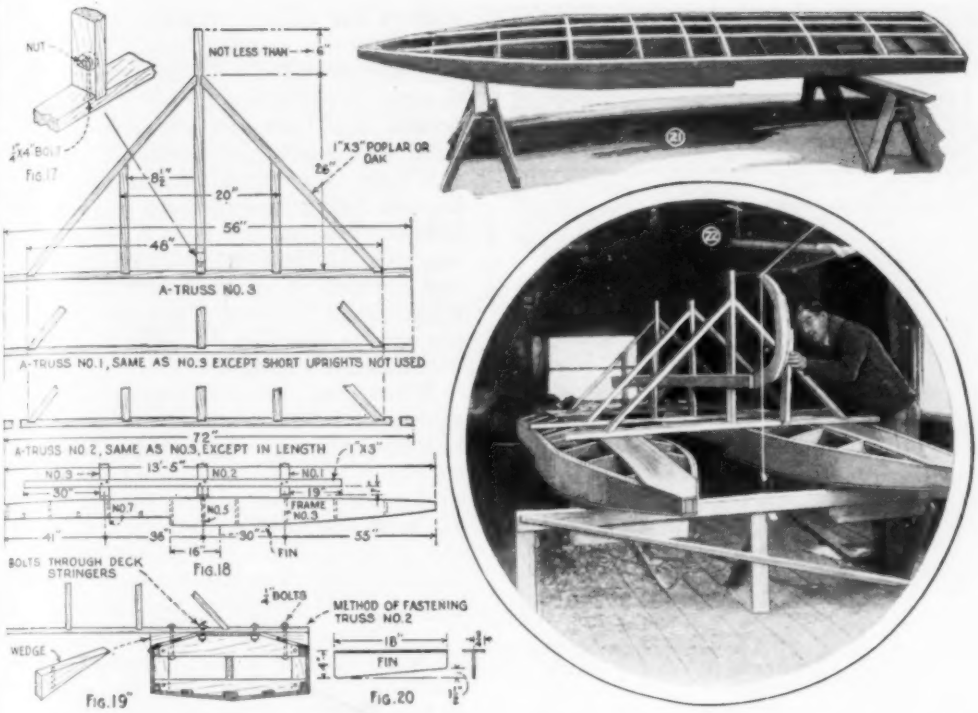


FIG. 15

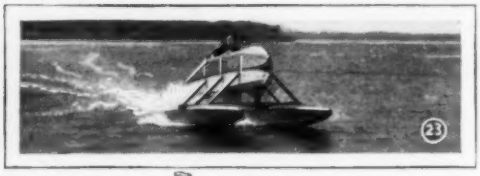




Before permanently screwing on the side planking, plane down the chine and deckline batten to allow as much surface as possible to touch the planking. Then coat the chine, batten and edges of the frame, similarly made to fit, with liquid marine glue and lay ¾-in. cotton tape over the chine, sternboard and extreme rear end of the deckline batten for calking, as these parts are to be under water most of the time. Do not apply the tape to parts above water. Clamp down the side planking and drive in ⅞-in. No. 5 screws. Space them 3 in. apart along the deckline batten at the front, and gradually reduce the spacing to 2 in., about 3 ft. ahead of the sternboard. Along the rear chine the screws are staggered and spaced 1½ in. apart, continuing this spacing up to frame 3, where the spacing may be 2½ in. Note the spacing of screws along the step and sternboard as shown in Fig. 6.

After screwing the sides on permanently, remove the props and also the keelson from the support board. Turn the frame upside down on two level sawhorses, as in Fig. 16, and run two battens lengthwise over the bottom, where the edges of the bottom planking are to butt together, recessing the battens to come flush with the frames. Plane the edges of the keelson down flush, making it slightly V-shaped. Keelson and battens are then screwed to the frames with 1½-in. No. 5 screws. On one side of the keelson cut a V-shaped notch, or limber hole, in each frame as shown at frame 7, Fig. 1, but not in the step and sternboard. Do not omit this for any reason, as these holes permit water to run toward the rear where it can be sponged out through small openings provided for the purpose. Plane down the bottom edge of the chine and side planking, and apply glue and cotton tape as before, after which the bottom planking is screwed on, using ⅞-in. No. 5 screws. Space them 2 in. apart along the keelson, battens and frames, 1 in. at the step and similarly at the sternboard, but running two rows in the latter.

A heavy coat of shellac or paint on the inside of the bottom and sides is necessary to prevent absorption of water so that the boat will remain light. The deck beams, shown in Fig. 7, are cut out of oak or poplar, and bolted to the uprights of the frame. From frames 3 to 8 the beams are the same size. A ½-in. strip is sunk



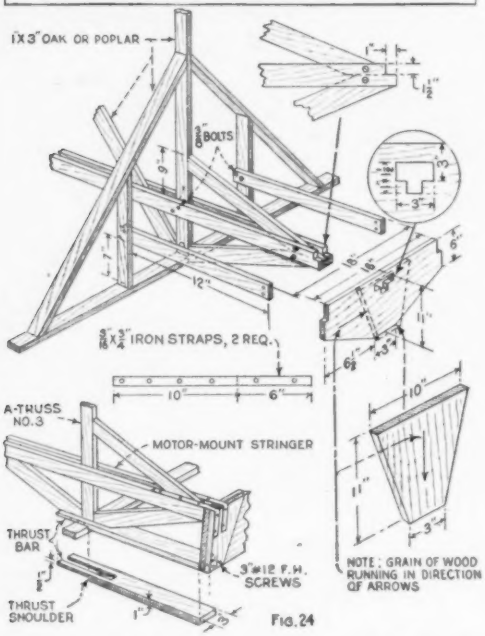


FIG. 24

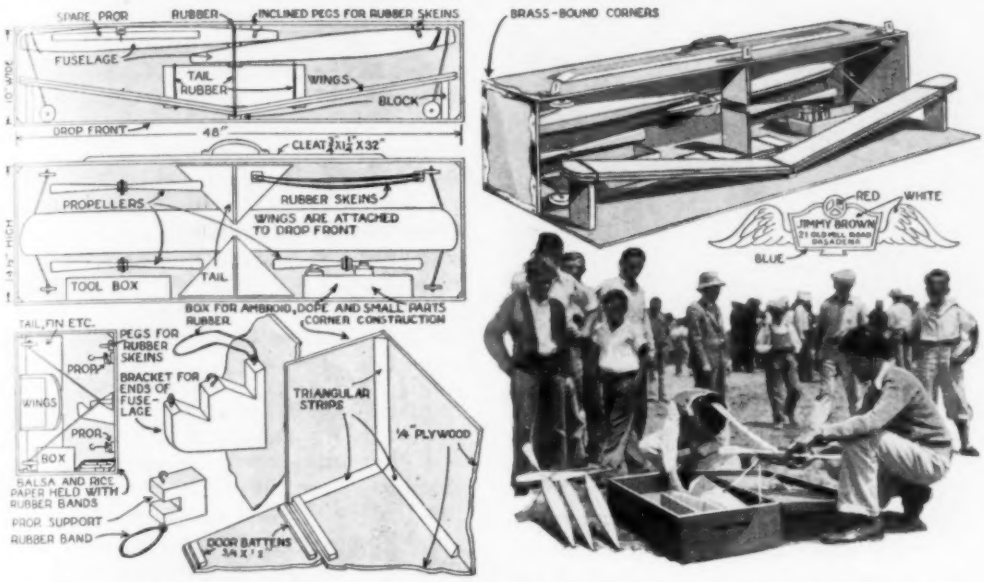
into the inside of the frame uprights directly under the beams to support them, after which the latter are bolted in place. To distribute the weight of the superstructure, added later, set 1-in. supports on edge between the frames and the beams, as shown in Figs. 11, 12, 13 and 15. Two of these supports are required, one between frames 4 and 6 and the second between frames 7 and 8. A curved cut-out at the top of the former, Fig. 14, facilitates sponging out water. Should these supports be omitted, the deck would probably crush in when the craft is used in rough water. Deck stringers of 1-in. square oak or poplar are sunk into the beams and sternboard, and are mitered to the deckline battens at the front, as indicated in Fig. 11. This detail shows the construction of the entire frame without the side and bottom planking and the planking battens. The deck stringers are bolted to the beams as in Fig. 13, after which the catwalk, of ½-in. cedar, is screwed on in the same way as the planking. The lids on the openings used to sponge out water are held down tightly with a length of spring steel. Such openings are provided between frames 5 and 6, and between frame 8 and the sternboard. The latter section is decked over solid with ½-in. cedar, while the rest of the deck is covered with canvas, ½-in. battens being provided to support the canvas. The canvas is tacked along the top edge of the sides with copper tacks, and molding is screwed over the ragged edge. It is, however, best not to apply the canvas covering until the superstructure has been completed.

When both pontoons are finished, a couple of 8-ft. sawhorses are made, and boards cut to fit the underside of the pontoons are attached to the horses as shown in Fig. 22. Be sure that these supports are attached solidly, and that they hold the pontoons level and perfectly parallel to each other. The success of the finished boat depends greatly on the accuracy observed here. The three A-shaped trusses or supports for the superstructure are made of 1 by 3-in. oak or poplar, as shown in Fig. 17. Fig. 18 gives their relative position with respect to the frames of the pontoons. Truss 2 comes directly over frame 5, as shown in Fig. 19. Wedges under this truss provide additional rigidity, and ¼-in. bolts hold the truss, wedge and beam together, while smaller bolts are run through the catwalk and the deck stringers. The other trusses are similarly bolted to the catwalk and deck stringers but as they are shorter than truss 2, no wedges are used. The motor-mount assembly is also securely bolted together.

Note the sheet-metal fin in Fig. 20, which is attached to the center of each pontoon at the position indicated in Fig. 18. Truss 3 carries the motor mount, and its construction is shown in Fig. 24. The motor-support board is carried on the stringers, the central one being reinforced by diagonal braces and mortised into the motor-support board. An oak thrust shoulder runs from the lower edge of the latter to the truss, and an extra plate, with its grain running vertically, is screwed to the motor-support board to give additional strength.

The construction of the superstructure or fuselage will be described in the August issue.

HERE IS A SAFE KIT TO CARRY YOUR MODEL PLANE



Why Not Make a Lightweight Traveling Kit to Hold Your Model Airplanes to Protect Them from Possible Damage While in Transit? Keeping the Plane in Perfect Trim Is Essential to Win That Race

For model-airplane meets and tournaments, where you wish to get the most out of your plane, a traveling kit is about the only method of avoiding damage to it. Plywood, about ¼ in. thick, is the best material to use, as it is light and strong. The sides are screwed and glued to triangular corner cleats. Blocks and brackets are screwed to the sides and back to support fuselage, tail assembly and props, and suitable pieces are fastened to the drop front to carry the wings. .Two inclined pegs are provided on the back to carry skeins of rubber, and boxes accommodate small parts, such as ambroid, wing dope and tools. Extra pieces of balsa and sheets of rice paper for repairs are fastened to the bottom with rubber bands. In case the kit is intended for shipment by express, lids must be provided for the tools and boxes, and the contents should be packed in excelsior or cotton so that they will not shake about in transit. Hasps are provided for padlocking the drop front. If cutting the plywood by hand, a fairly fine-toothed saw should be used, to prevent splitting the thin layers, and the edges are best finished with coarse sandpaper held on a flat block. Metal-bound corners will improve the appearance and increase the strength of the box. They can easily be cut to shape with tin shears from sheet brass and bent to shape. Do not use too thin metal, as the edges may bend out and will then catch on clothing. A brass handle can be purchased at almost any hardware store. Do not fasten it directly to the top piece of plywood, but first attach a long cleat to reinforce the thin top. The four bottom corners can be fitted with small metal furniture rests. An attractive finish for the outside is walnut or mahogany oil stain, which should be applied before the brass fittings are attached. Rub the surplus stain off with a dry cloth after it has had time to soak into the grain well. A chinese red on the inside makes a striking effect and sets off the contents in strong relief. A nameplate is easily painted on, if desired. This handy kit involves very little work and almost anyone can make it—certainly the boy who is clever enough to build a plane that will fly.

¶Before putting the razor away draw the blade across the hair several times; the oil in the hair leaves a film on the razor that suffices to prevent the blade from rusting.

New Photo Paper Enables Ordinary Snapshots to Assume Color When Illuminated from Rear

Transparent Photos Are Illuminated with Small Lamp and Reflector

Transparent photographic paper, printed on both sides, the front side intended for use in reflected light and the back for use with illumination from behind, opens a new method of photo display in the home. When the print is held so that light passes through it from the rear, a picture of surprising brilliancy is seen. Additional beauty can be obtained by coloring the back with pure concentrated aniline dyes or oil colors thinned very slightly, applying the colors much more heavily than ordinarily. Coloring should be done with the picture resting against a window or otherwise arranged so that light passes through it. When the print is completed, inclose it between two pieces of glass and mount it in a frame of the type shown in the photo, a narrow border of opaque paper, about ½ in. wide, also being placed between the glasses. The border is primarily used for the purpose of concealing small nails which hold the glass in place, and also to prevent light from getting through at the edges. The reflector can be made from sheet aluminum. It is bent to a concave shape with a maximum distance of 2½ in. between the glass and the reflector. The sides are flattened so that they can be tacked or screwed to the back of the picture frame, and the open top must be closed to prevent light from escaping. The bottom end may be left open for ventilation. Inside of the reflector a small miniature socket and lamp are installed, the socket being held in position by means of a bracket attached to the reflector. A suitable length of lampcord is provided to reach to the nearest wall outlet. Now, when you wish to attract the attention of visitors to this photo, merely turn on the light. What has been a colorless, conventional photo a moment before suddenly assumes natural hues and becomes a scene of lifelike beauty.

How to Clean a Clock

The works of a clock can be cleaned at home with caustic soda, benzine and warm water. Allow the clock to run down so that the springs will be open as far as possible. Take the works out of the case and remove the dial and hands. Run hot water over the works, moving them around so that the water reaches all parts, and rinse in a solution of caustic soda, 1 tablespoonful to 1 qt. of hot water. Then rinse the works in benzine and again run hot water over them, after which the water is shaken off and the works rinsed in denatured alcohol, and allowed to remain in the alcohol for about five minutes. Remove the works and set in a warm place to dry, covering them to keep out the dust. Replace the hands and dial and fasten in the case.

Large Reel Dries Fishline Quickly

Fishing lines can be dried quickly after use by winding them on a large reel. It consists of a wooden block that serves as the base, a small upright and the reel

This Reel Dries Your Fishing Line Quickly and Will Make It Last Longer

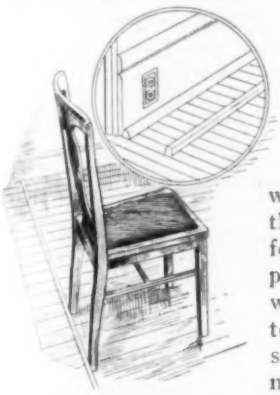
proper, which is made up of two pairs of crosspieces spaced apart with nails as indicated. A small crank is attached to the reel to turn it in winding up the line directly from the casting reel on the pole.—Arthur Sharpe, Willimantic Conn.

Low Spots in Eave Gutters Filled with Roofing Pitch

Low places in eave gutters can be filled by pouring melted roofing pitch into the eaves until it starts to run into the conductor pipe. The pitch, when hard, forms a gradual slope for the water to flow toward the spout. This prevents the water from accumulating in the low spots where it provides a breeding place for mosquitoes, and may cause the gutter to rust through.—Nathan R. Baker, Westport, Indiana.

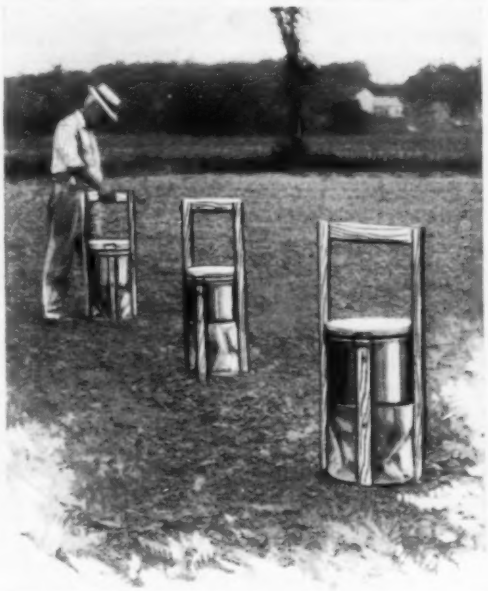
Rail on Floor Keeps Chairs from Marring Wall

Chair marks on walls, which ruin the wallpaper, can be effectively prevented by nailing a small strip of wood to the floor, parallel to the wall and at a sufficient distance from it to keep the wall safe. A strip of hardwood, matching the floor, will be found best for this purpose as soft wood will break too easily. The strip is scarcely noticeable.



Enamel Mends Cracks in Fish Bowl

A crack in the bottom of a fish bowl, which allows the water to seep through, can be mended by applying two coats of enamel paint over the crack inside and outside of the bowl. The first coat should be thoroughly dry before the second is applied. The sand and other decorations usually kept in the bottom will cover the enamel so that it will be unnoticeable.—Truman R. Hart, Ashtabula, Ohio.

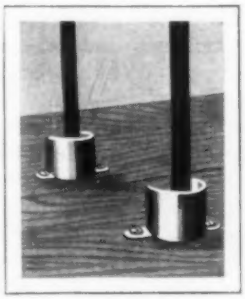


Effective Method of Dusting Plants Used on the Purdue University Horticultural Farm

Plant Duster Used in Wind

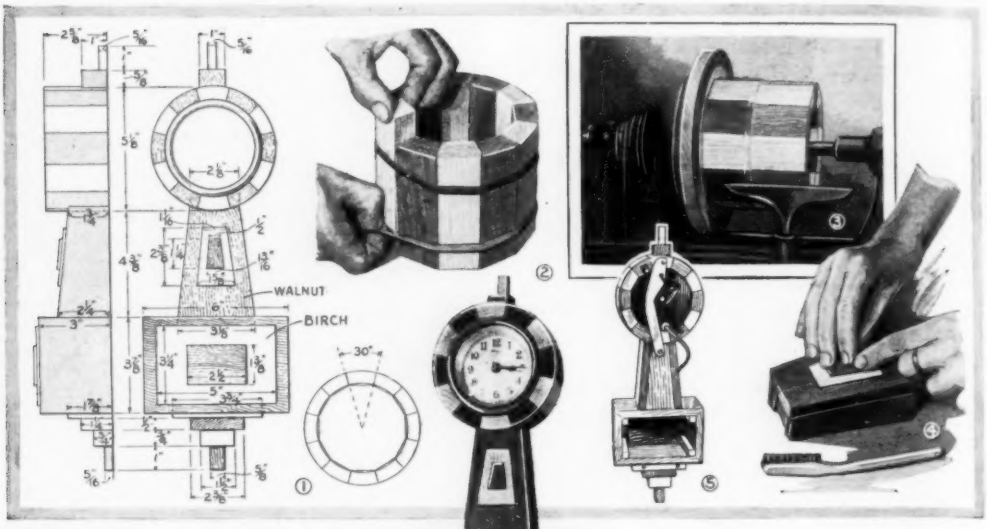
Dusting plants to kill insects is a difficult job when the wind blows. Take a 5-gal. can and punch holes in the bottom. Fasten four pieces of wood for legs, allowing two of them to project above the top of the can to support a handle, as shown. A canvas skirt, extending to the ground, is fastened around the bottom of the can to prevent the dust from escaping. By having three or four of these dusters, much time will be saved.

Neat Guards for Small Bench Belts



Guards to prevent tools and material from getting in contact with small belts running through bench tops, can be made from brass closet-rod brackets, obtainable at any 10-cent or hardware store. Place the brackets around the belt and screw them down with the open side toward the back of the bench.

AN ELECTRIC BANJO CLOCK OF MODERNISTIC DESIGN



Black walnut and light birch or maple, finished in natural color, provide a contrast that is highly effective for this banjo clock, which houses an electrically driven movement and has a dial about 3½ in. in diameter. To make the cylindrical part, rip some ¾-in. strips of the two kinds of stock mentioned, and cut off six 6-in. lengths of each. The width of the strips depends on the size of the clock face, and allowance must be made for recessing the face, as indicated in Fig. 1. A circle of the same diameter as the outside of the clock face is scribed on a piece of paper. A second circle, with a radius ¾ in. larger than the first, is then scribed concentrically and 12 radial lines are drawn through both circles from the center, dividing them into 12 equal segments, which represent the width of the finished strips. When ripped, they should, of course, be slightly larger, and the edges are then beveled on a jointer or with a hand plane. Assemble temporarily, holding the strips together with rubber bands as in Fig. 2, after which glue is applied to adjoining edges and the assembly clamped with loops of rope twisted tight. Be sure that the end of the cylinder is true so that it can be properly mounted for turning as in Fig. 3. A wooden disk is screwed to this end, the disk being in turn fastened to the lathe faceplate, while a small block, glued across the other end, forms a support for the tailstock center. After turning to shape, cut off the section to house the clock, which should be about 4 in. long. Building the rest of the clock is a comparatively simple matter by following the constructional details and sizes given in Fig. 1. The edges of the rectangular portion are mitered, while those of the intermediate part are rabbeted. Supporting strips, glued in the corners as indicated in Fig. 5, add strength. Decorative effect is obtained by gluing small blocks and strips of contrasting wood to the top, front and bottom, as shown in Fig. 4. After the movement has been installed, screw a strip of sheet metal across the back to hold it in place securely, unless the metal back of the original clock can be used for this purpose. If possible, have an electric outlet installed directly behind the box portion of the block to conceal the cord and plug.

Glue Solution Cleans Woodwork

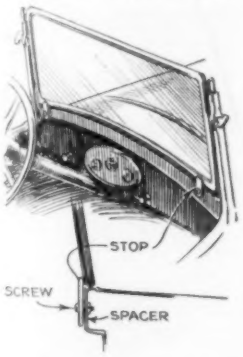
Enameled woodwork can be easily cleaned with a glue solution. Thoroughly mix 3 tablespoonfuls of powdered glue in 10 qt. of warm water. Rubbing the wood with this solution will remove dirt quickly.—Lola E. Litton, Lincoln, Nebr.

Making Cordage for Model Ships

Cordage of exactly the right size for rigging on model ships is not always available, but can readily be made in the following manner: Get some thread heavy enough to represent the individual strands of the rope to be made. Double it several times, keeping the total length greater than needed for the finished rope, then tie a knot at each end to hold the strands together, and apply beeswax. Now insert a coarse crocheting hook in the chuck of a small hand drill and catch the hook through the loops at one end. Similarly loop the opposite end of the strand over a small hook or nail driven into the wall. Turn the drill so that the threads will be twisted to form a rope of the desired diameter. Grasp both ends of the rope while thus twisted and quickly pass it through a gas or candle flame, thereby melting the wax, which permeates the threads and cements them together.

Stops for Windshield

On many model-A Ford cars of the open type, the windshield has a tendency to blow open, especially when driving fast, letting rain get past the rubber weatherstrips. Sheet-metal stops attached to the dash and bearing against the windshield frame, as shown, will prevent this trouble. The stops are held to the small panel just below the windshield with machine screws run into the tapped holes already there, the upper screws on both sides being first removed, because they are too short to hold the stops. The kind used to hold the pan to the frame, ahead of the radiator, are the right size for this purpose.



A large blueprint No. SN-7, covering the pontoon and truss construction of "Aero-Boat," can be obtained for 25 cents; material list will be sent to anyone upon request.

Improvised Reel Holder Pushed Along Single-Handed, Unwinds Barb-Wire Fencing

Barb-Wire Fencing Unrolled in Wheelbarrow Fashion

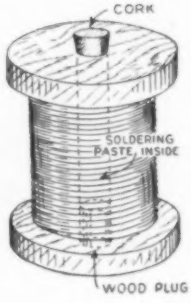
By providing a pair of handles, properly spaced and fitted with two crosspieces for rigidity, as shown, and slipping an iron rod through two holes at the lower end and through the roll of barb-wire fencing, this readily can be unwound in wheelbarrow fashion. To prevent the rod from slipping out, it should fit rather tight in the handles, or, if desired, it may be threaded for a washer and nut.—Ralph Hanenkratt, Johnstown, N. Y.

Adhesive Tape for Price Tags on Glass and Pottery

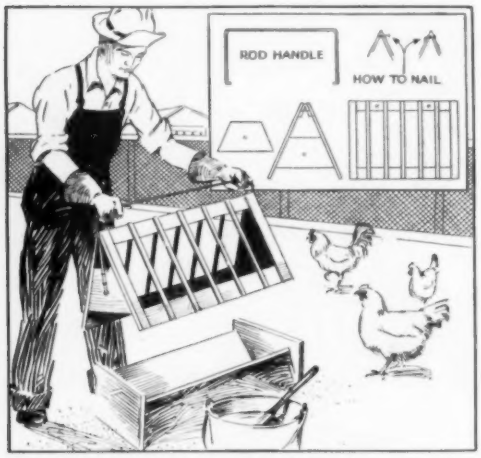
Price tags that stick can be made by cutting adhesive plaster into small squares. The fabric side of the tape provides a writing surface for ink or pencil which will not be deleted by frequent handling. —James C. Ramsey, Ruidoso, N. Mex.

Soldering Paste Kept in Spool

Soldering flux, in paste form, can be kept in the center of a spool on which the wire solder is wound. Tightly close one end of the spool with a wooden plug, and insert a small cork at the other. Time and space are saved with this arrangement.



Trough with Wooden Grate Saves Poultry Feed



This Wooden Guard for Covering Water and Feed Troughs Keeps the Poultry Out

To keep poultry out of water and feed troughs, the illustrated guard will be found effective. Make two grates, 18 in. high and long enough to fit between the ends of the trough. Nail the grates to triangular endpieces and place the guard over the trough. If desired, a handle may be added.

Ferrotype Plates Redressed Quickly with Bottled Solution

Both professional and amateur photographers using ferrotype plates will find that the time required in resurfacing them can be greatly reduced by keeping the dressing solution in a bottle and melting it when needed. It consists of benzine and beeswax, or gasoline and paraffin. The usual process of dissolving these substances is very slow. When kept in a bottle, however, the latter can be placed in a can of hot water and the contents will be melted and ready for use in about one minute. The preparation will spread more quickly than when it is used cold.

How Asbestos Can Be Strengthened with Water Glass

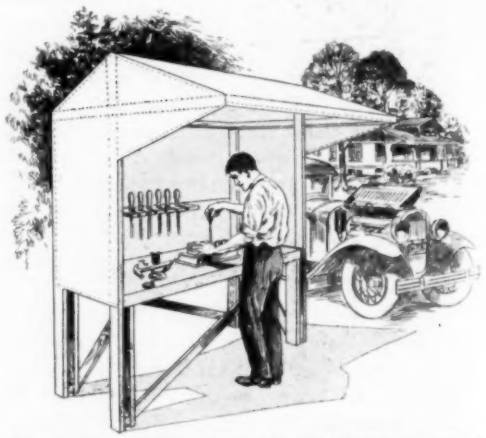
Asbestos can be made more durable for holding resistance wire by soaking it with a solution of sodium silicate and water, mixed in equal proportions, and letting it dry thoroughly before using. Other advantages of this treatment are that the board will be easier to drill and saw, while untreated asbestos has a tendency to tear. As water glass is often used as a fireproofing solution, it is evident that it will not affect the fire-resisting qualities of the asbestos. Also, an asbestos board can be built up from a number of thin sheets individually soaked in the solution, clamped tight between two pieces of wood in a vise.—Louis Palmbeck, Jr., Moline, Ill.

Tinfoil on Lamp Serves as Shade

A reflector for an ordinary lamp can be made with a piece of tinfoil wrapped snugly around the upper portion, where it will remain attached without the use of glue or cement. The same idea can also be followed in indirect lighting effects where lamps are used in an inverted position on fixtures.

Sun Canopy for Outdoor Workbench

For those who desire to work outdoors, it is a good idea to provide a bench canopy as shown in the illustration. Vertical supports of 1 by 4-in. stock are nailed to the legs of the bench and two horizontal crosspieces are attached to the supports about 4 ft. above the bench top and should extend about 3 ft. beyond the front edge. Other framing pieces can then be added, including one across the back to serve as a tool holder. Canvas is stretched and tacked on over the top, sides and back. Besides forming a sun shade, this canopy will also protect you in the rain.



Canvas Cover on Workbench for Use Outdoors Protects the Worker from Sun and Rain

Varicolored Designs on Woodwork Easily Obtained

To obtain a varicolored finish on woodwork, remove the old finish and thoroughly clean the surface. With a spray, apply several coats of different-colored quick-drying enamels, allowing each coat to dry before applying the next. After the enamel has dried thoroughly, rub the surface with a piece of fine sandpaper until the desired color appears.—Raymond Goforth, Dallas, Tex.

Typewriter Silenced with Sponge Rubber

Noise caused by operating a typewriter on a desk, can be greatly reduced by placing pieces of sponge rubber under the feet. Similarly, a sponge-rubber pad will prevent the typewriter from "creeping" on a table surface.

Upsetting of Lantern Prevented with Concrete Base

Lanterns that are used on construction jobs are not likely to be upset or stolen if provided with a concrete base. Make a sheet-metal form, 12 to 14 in. in diameter and 6 in. wide. Set the lantern in the form so that the filling hole will not be covered by the concrete, which is then poured in. The form should be left on as it provides strength.—Howard Fowler, Rogers, Ark.

Shellac Aids in Calcimining

When putting calcimine on ceilings that have become blackened with smoke and grease, first wash the ceiling with a strong solution of sal soda and water. After it has dried, apply a thin coat of shellac. Be sure the ceiling is free from soot and grease before applying the shellac, or the spots will show through the calcimine which is put on as soon as the shellac has dried.—E. W. Poplawski, Depew, N. Y.

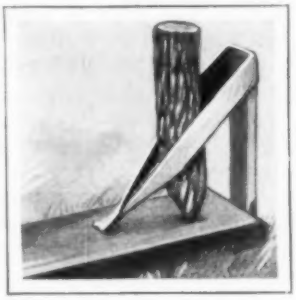
Where You Have Lost or Broken a Minnow Trap, Try This Improvised One for Results

Fruit Jar Catches Minnows

An emergency minnow trap can be made from ½-gal. fruit jar or other similar glass container, and a piece of celluloid, about 3 by 10 in. in size. Roll the celluloid into a funnel shape, so that the wide end fits snugly in the mouth of the jar, prick holes through the overlapping edges and lace them together with twine. Now insert the funnel with the wide end in the mouth of the jar as illustrated, and tie it securely in place, holes being punched along the edge and twine used for tying.

An Inner-Tube Support on Block for Splitting Firewood

This holder helps to overcome the danger of splitting firewood having uneven ends. Nail a small board of sufficient height to one end of the splitting block. Then stretch a piece of inner tube from the top and nail it down. The rubber holds the wood upright.



Practical Printing Frame, Attached to Darkroom Window, Utilizes Daylight to Expose Prints

Photo-Printing Frame on Window Uses Natural Light

In localities where electric light is not available or a constant, uninterrupted supply cannot be depended upon, a daylight printing frame, attached to the darkroom window, will be found entirely practical. Make a frame to fit snugly over the window and cover it with heavy fiberboard to exclude all light. Cut out a portion in the center and fasten a pair of slides to hold a small door, which covers the cut-out, the door being raised and lowered by means of a cord run over two small pulleys at the top of the frame. Build the printing box directly in front of the opening, screwing it to the slides and allowing sufficient space for the sliding door. Fit a piece of plate glass in the top and a hinged cover over it. With this arrangement, the sliding door can be pulled up to admit light for exposing a print, without getting it in the darkroom. If desired, a small opening, fitted with a piece of ruby glass or fabric, can be provided above the open position of the sliding door to admit red light.

¶A little soap added to gasoline for cleaning satin garments increases their luster.

Acid Spray from Bottles Confined with Wet Cloth

A wet cloth held over the stopper and around the neck of a bottle containing acid will prevent it from spraying out when opened in a high temperature, due to pressure developed inside the bottle when hot. This is especially true with nitric acid. It is advisable for those handling acid to have a pan of clean water and soda at hand, as soda neutralizes the acid and arrests its action.

Rattling of Window Is Prevented by Rubber-Covered Wedge

Rattling windows can be cured by slipping a rubber-covered wedge between the window and the casing. A section of an old inner tube is cut equal to the width of the wedge and stretched over it lengthwise. The wedge can also be used to hold doors open.

Sweating of Pipes Cured with Cork

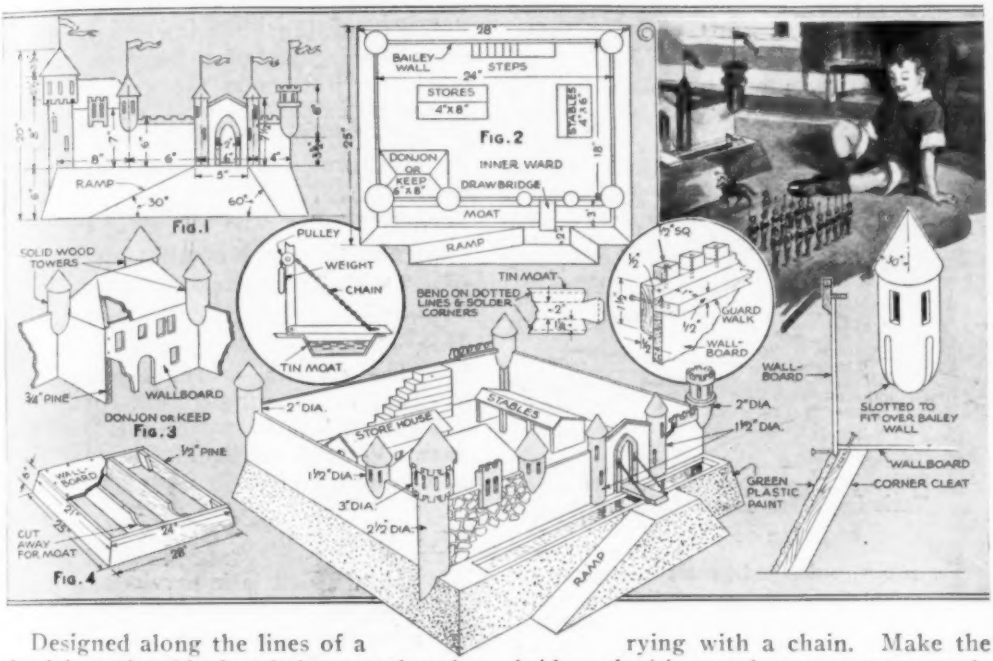
On hot days, cold pipes are often covered with drops of water, due to the humidity of the air which condenses on the surface. By coating the pipes with roofing paint and applying ground cork while the paint is still tacky, a covering is provided that will effectively prevent the pipes from sweating.

Sidewalk Protected from Tree Roots by Iron Grating

To avoid a broken sidewalk due to growing tree roots, one home owner found an iron grating successful. It is installed so that one can readily remove it to cut off portions of the roots as these grow and raise the grating.

Installation of Removable Iron Grating Prevents Tree Roots from Injuring Sidewalk

FEUDAL CASTLE HOLDS AN ARMY OF LEAD SOLDIERS



Designed along the lines of a feudal castle, this fort helps to solve the housing problem of lead soldiers. There is real water in the moat and the drawbridge can be pulled up. The use of a lightweight wallboard, about 3/16 in. thick, simplifies construction. Start with making the base, as shown in Fig. 4. Cleats are nailed in the corners and two crossbraces installed for reinforcement. Portions of the latter should be cut away to accommodate the tin moat. Wallboard is used for the floor and walls. The battlements shown in the right-hand circular insert are made up of individual blocks, ½ in. square and nailed to a molding strip, with a guard walk running along the inside. Before putting on the battlements, all towers, which are turned in the lathe, should be set. The diameters are given in the perspective view. The corner towers straddle the walls and must be slotted to fit over them. In slotting, first drill 3/16-in. holes at right angles and saw toward them. After they are placed on the wall, putty up the visible portions of the slots. Dummy windows are simply recesses chiseled about ¼ in. deep. For the frame of the gate at the drawbridge, use pieces ¾ in. square, slotting each to receive a pulley, 1 in. in diameter, for carrying with a chain. Make the bridge of ¾-in. stock, swung on an axle through the door frame, and round the edges to clear the floor. Holes in the floor allow the lead weights to go all the way down when closing the bridge. The moat is cut from a single piece of tin. Paint it brown inside to prevent rust and to resemble a mud bottom. Fig. 3 shows details of the donjon. The end wall and ends of the roof are of ¾-in. wood, while the rest is wallboard. Set the towers before putting on the roof and cut the latter to fit around them. Stables and storehouse are made in the same way. The stairway is built up of ¾-in. blocks, 1 in. wide, the lowest 9 in. long, and the remaining blocks each ¾ in. shorter than its neighbor below. Bright red roofs contrast nicely with the stone walls, and masonry can be imitated by giving the walls a gray ground coat and, when dry, painting in the stones with a brownish-gray. Deep blue or ultramarine in the windows gives the effect of deep shadows. The base is covered with green plastic paint, mottled to resemble sod.

¶Crimped caps driven at the bottom corners of a tool chest or other heavy box will allow it to slide more easily.

Twisting of Flat Iron in a Pipe to Avoid Bending

Twisting Flat Iron Uniformly in Piece of Tubing

To avoid undesired bends in a piece of flat iron while twisting it, slip the work into a length of pipe of slightly larger size. One end of the iron is held in a vise and the other end is gripped with a large monkey wrench, which is used to do the twisting. Bending the iron inside of the pipe is practically impossible with this arrangement, although it may wedge against the side, but can then be readily removed by tapping the piece out with a hammer.—E. F. Manthey, Fennville, Mich.

Preventing Perspiration Stains on Hat Band

To prevent perspiration from staining the band on a hat, insert a strip of heavy waxed paper, about 2½ in. wide, between the sweat band and the inside of the hat. The paper should be renewed frequently in warm weather.—J. E. McQuaid, Cincinnati, Ohio.

Loose-Fitting Flashlight Bulbs Cured with Tinfoil

In case the socket of your flashlight is too large to hold the bulb snugly, wrap the stem of the latter with a piece of tinfoil, pressing it on tightly. When replaced, the bulb will not slip out or cause a short circuit.—P. B. Bacheller, Mt. Vernon, Me.

Grass Clippings Hold Moisture in Garden Soil

After mowing your lawn, spread the grass clippings between the rows of vegetables or flowers in the garden. This makes a "carpet" to walk on when the ground is muddy and also helps to hold the moisture in the ground during dry weather.

Goggles Can Be Made Shatter-Proof with Transparent Lacquer

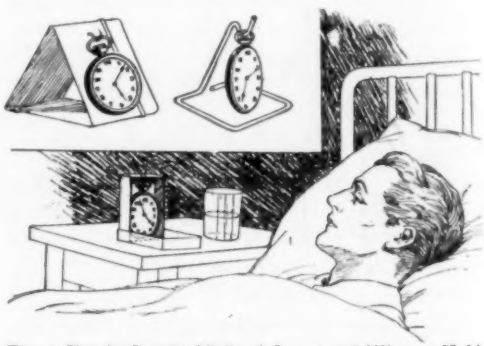
Goggles used for driving, or for indoor work where the eyes must be protected from flying particles, can be made shatter-proof by applying a thin coating of transparent lacquer to the inside of the glass. Waterproof liquid fingernail polish can be used for the same purpose.

An Acid-Proof Tank Lining

A paint, which is impervious to most acids and will be found excellent for use in coating the inside of tanks, can be made as follows: Mix 75 parts of pitch by weight with 9 parts of plaster of paris, 9 parts of ocher, 15 parts of beeswax and 3 parts of litharge.

Watch Stands for Bedridden People

While in bed in a hospital I could not see a watch lying on a table, so I devised the illustrated methods of holding it. The simplest of these is to set the cover of a small paper box in a vertical position on one end, hanging the watch inside by means of a string slipped through two holes punched in the lid. Another stand can be quickly improvised from a length



Three Simple Stands Made of Paper and Wire to Hold Patients' Watches

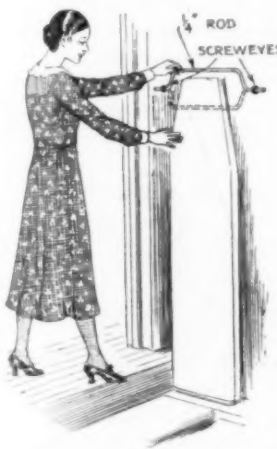
of cardboard folded to a triangular form with the overlapping ends pinned or glued together. A small wire through the cardboard forms a hook on which the watch is hung. A 12-in. length of wire can readily be bent to form the holder shown in the upper right-hand detail.—Fred C. Koch, Minneapolis, Minn.

Sprinkler Holes Opened with Small Drill

In localities where the water supply has a high content of minerals, the holes in the sprinkler head of shower baths often become clogged. By using a drill of the proper size, the holes can easily be reamed out. This method can also be used to correct the direction of the individual streams.

Ironing Board Held to Wall with U-Shaped Clip

A length of ¼-in. iron rod or even heavy wire, bent to form a U-shaped clip and fastened to the wall with a couple of screweyes as shown, will hold the ironing board from falling over as indicated in the sketch. When the board is needed, the clip is simply swung back.—Paul Ravis, Camden, New Jersey.

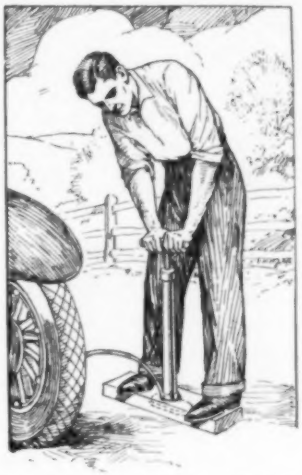


Tightening Fishing-Rod Ferrules

When brass ferrules on steel fishing rods come loose, they can be repaired by "sweating" them on with solder. Thoroughly clean the part of the rod that fits into the ferrule and coat it with solder, using muriatic acid, cut with zinc, as a flux. Heat the ferrule to a dull red and push it over the soldered portion of the rod, immediately immersing the rod into cold water. This causes the ferrule to contract and form a snug and permanent joint.

A Wooden Footrest for the Pump

A wooden footrest for the tire pump will often be found convenient. It consists of a piece of 2 by 4-in. wood having a hole drilled through the center to fit over the pump cylinder and hose, and a recess chiseled out to receive the regular pump footrest.—Erich Dallmer, S. Ozone Park, N. Y.

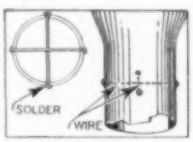


Newly Planted Trees Thrive on Oat Sprouts

An orchardist who has been successful in getting newly planted trees to grow, uses sprouted oats, which makes a food the roots can easily absorb. When planting the tree, throw a quantity of oats around the roots. Pour water on both and fill the hole with rich soil. In a few days the oats will sprout, but the sprouts will soon decay, forming fertilizer.

Siphon-Proof Filler Spout Saves Your Gas

Siphoning gasoline from fuel tanks on outboard motors can be quickly stopped by fitting a guard in the spout that prevents the hose from entering but does not obstruct the flow of gasoline, when filling it. Drill two pairs of holes through the spout where it narrows down, to receive two lengths of wire so that they will cross each other at right angles. File off the projecting ends of the wires flush with the spout and apply solder to avoid leakage of gasoline at these points. Anyone attempting to run a hose into the spout will find an effective obstruction.—J. N. Stoody, Kenosha, Wis.



Drawings of Any Length Can Be Handled on the Drawing Table by Using a False Edge

Draftsman's Table Has False Edge for Handling Long Drawings

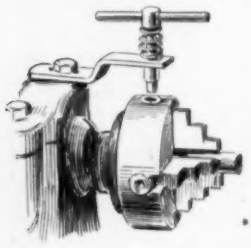
By attaching an extension edge to the draftsman's table with blocks at the corners, drawings of any length can be made without inconvenience in using the T-square, as it slides against the false edge. Of course, the edge must be planed perfectly straight. A 2-in. piece of hardwood is most satisfactory for this purpose.

Water-Soaked Gaskets Do Not Leak

Engine-head gaskets can be kept tight by soaking them in water before installing them. The additional use of grease or gasket compound is not necessary, as the filler in the gasket shrinks when soaked and expands when dry.

Lathe-Chuck Wrench Kept Handy

Much time in looking for the lathe-chuck wrench can be saved by using the illustrated holder. Bend a piece of flat steel to form an offset, and drill a hole at each end, one for bolting it to the frame in the position indicated, and the other to accommodate the wrench directly over the square holes in the chuck. A coil spring keeps the wrench out of the way when not in use.—Chas. Walter, Louisville, Ky.



Asbestos Retains Heat in Small Soldered Parts

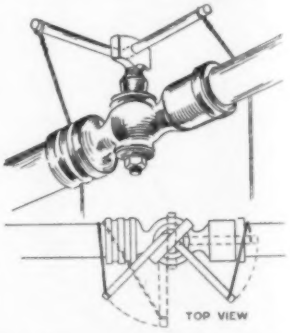
Small objects to be soldered must often be held in a metal clamp or in a vise, but these larger pieces of metal conduct the heat from the work so rapidly that it becomes comparatively cool, which results in a poor soldered job of rough appearance. The trouble can be avoided by placing small pieces of sheet asbestos between the work and the clamp.

Making Hollow Plaster Forms

When hollow plaster or concrete forms are desired, it is a comparatively easy matter to make them by pouring the material around a core molded from paraffin. As soon as the plaster has set, a small hole should be drilled at some inconspicuous point so that the paraffin will run out when heated.

Wire Control for Overhead Stop Cocks

Opening and closing of stop cocks, too high to be reached without a ladder, can be simplified in the following manner: Drill a hole in the center of the handle for a piece of iron rod, which is driven in and bent at right angles. File a groove at each end to hold a length of wire, tied on securely. The wires are then brought over the pipe and allowed to hang down on the other side. The cock then can be opened or closed by pulling the wires.



Burning on Storage-Battery Straps

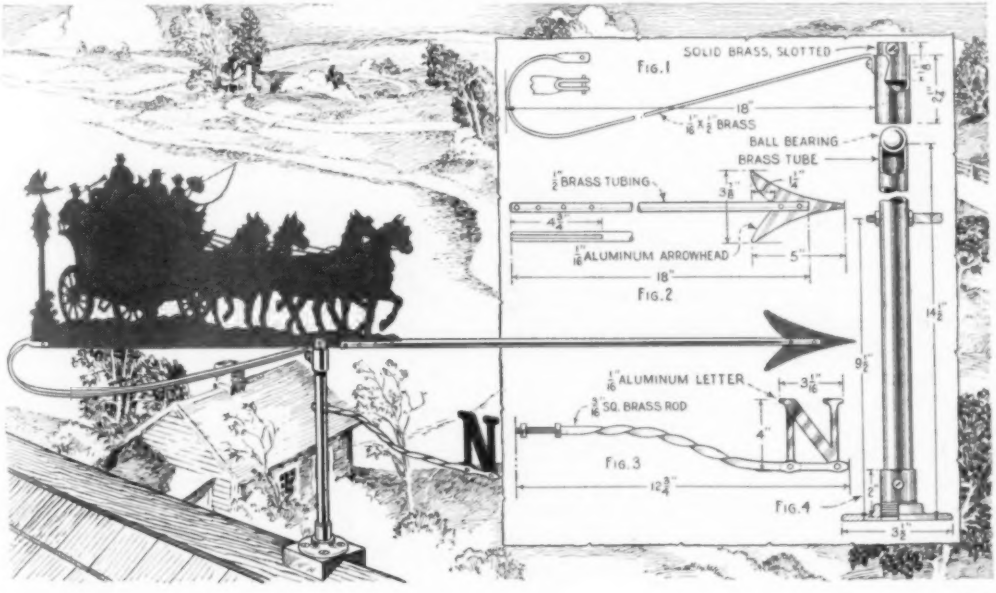
Sometimes, when burning on storage-battery straps, the lead has a tendency to form a molten ball instead of flowing together. In such a case just melt in a little acid-core solder which will make the lead run properly. Do not try this in a post mold, however, for the lead will adhere to the post as the acid tins the post.

A Noiseless Ball-Bearing Weathervane

OWING to its light construction and the provision of a large ball bearing, this 36-in. weathervane, which holds an attractive silhouette of an early American stagecoach, operates smoothly and noiselessly. In order to make the vane entirely rustproof, only brass and aluminum are used in its construction, with the exception of the bronze ball bearing and the iron floor flange, by means of which the vane is mounted on the roof.

The first thing to do is to make the stagecoach silhouette. Lay off 1-in. squares on a piece of paper, about 13 by 24 in. in size, and draw the template, following the crosshatched detail, Fig. 5. The design can be transferred to a sheet of aluminum, about 1/16 in. thick, by using carbon paper, and it is then cut out with a metal-cutting coping saw. All rough edges are carefully filed smooth.

Next comes the arrow, the shank of which is 18 in. long and consists of a length of 1/2-in. brass tubing, slotted at one end and drilled at right angles to the slot for attachment to the forward end of the silhouette. The other end of the shank is similarly slotted to receive the arrowhead, which is cut from 1/16-in. sheet aluminum. All of the details and dimensions are given in Fig. 2. The vertical support for the weathervane, Fig. 2, consists of a tube, 2 1/4 in. long and 7/8 in. in inside diameter, so that it can be slipped over a 14 1/2-in. length of brass tubing with an outside diameter of 7/8 in. The top end of the shorter piece is closed with a brass plug, while a brace of 1/16 by 1/2-in. flat brass is attached to the side, with a screw running through both the tube and the plug. The other end of this brace is bent around in a sweeping curve so that it can be bolted to the rear end of the stagecoach. The lower front edge of the sil-



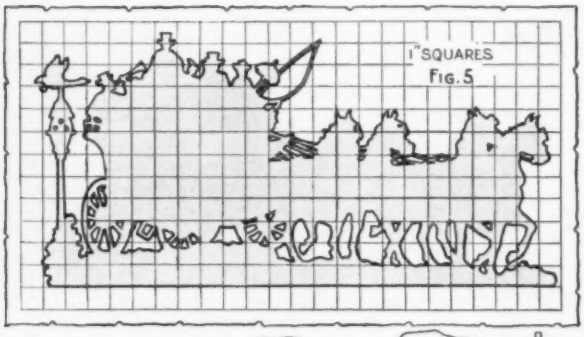


FIG. 5

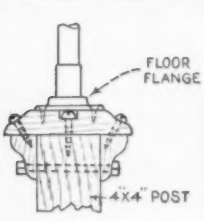


FIG. 6

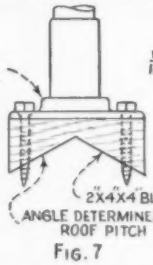


FIG. 7

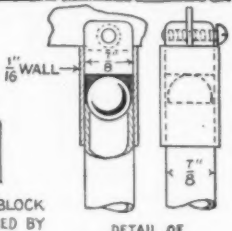


FIG. 8

Cutting This Stagecoach Silhouette from Sheet Aluminum Is an Interesting Job for Any Home Craftsman

houette fits in a slot cut in the top of the brass plug and is also held in place with a screw, as shown in Fig. 8. A ⅞-in. bronze ball bearing is then placed on the upper end of the 14½-in. length of tubing, after the edges have been reamed out to provide a smooth, cupped seat. When the upper assembly is slipped over the standard, the brass plug fits against the ball. The lower end of the standard is slipped into a 2-in. brass nipple, where it is held securely by means of a screw, and the nipple is in turn screwed into a floor flange provided with screwholes for attachment to the roof.

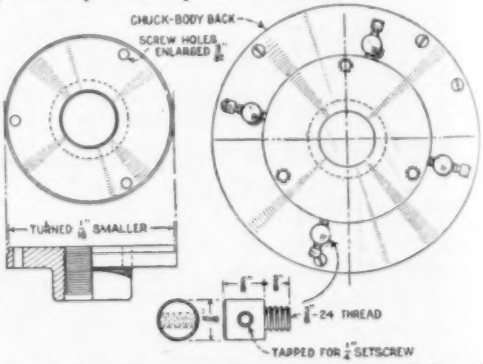
There are two methods of mounting the flange, given in Figs. 6 and 7, the former showing the flange directly on a post and the latter on a block having a V-shaped notch in the underside to fit the ridge of a roof. In the latter case it is well to use lagscrews through both flange and block to project into the ridge, suitable holes being drilled through the block for the screws to prevent it from splitting. The weathervane is now actually complete, but you may desire to add a pointer bearing the letter "N" and extending toward the north. The letter can be cut from 1/16-in. aluminum and it is mounted at one end of a twisted brass rod, 3/16 in. square, while the other end is turned around and threaded for a nut, as shown in Fig. 3, after which it is bolted to the standard 9½ in. above the base.—A. C. Ullrich, Park Ridge, Ill.

Sander Cuts Bevels on Belts

When gluing the ends of a leather belt together, it is sometimes rather difficult to cut the bevels evenly. By holding the ends of the belt against a revolving disk sander with a block of wood against the back so it will not bend, the bevels can be made even, and when glued will make a neat splice.—Hugh A. Brankstone, Pittsburgh, Pa.

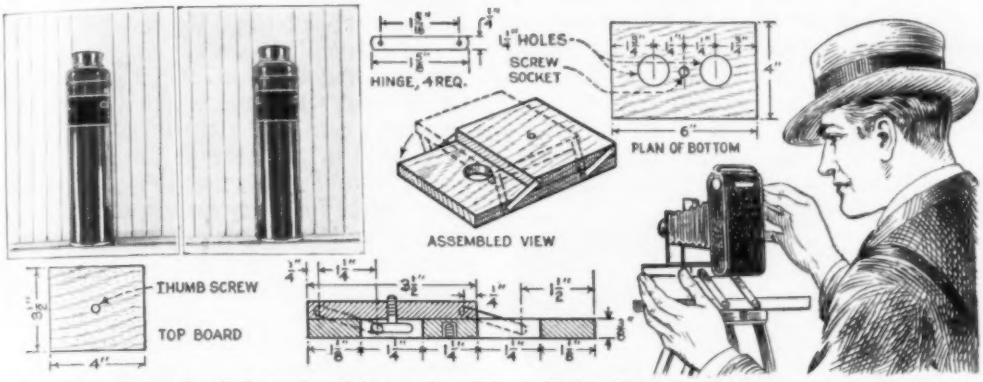
Centering a Universal Three-Jaw Chuck

When a universal three-jaw chuck does not run true, centering can be accomplished as follows: Drill and tap the chuck body for ⅝-in. steel posts, which are fitted with ¼-in. setscrews. Turn the chuck mount 1/16 in. smaller than the recess and enlarge the holes in the chuck mount about 3/32 in. To center the work, chuck the piece tight. Then loosen the three capscrews that hold the chuck on the mount and tighten them just enough to hold the chuck snugly against the face of the mount. With a T-wrench and an indicator, centering can be done in a few moments, after which the three capscrews are tightened. Remember that on the "high side" the setscrews are loosened, just opposite to what happens when using a four-jaw independent chuck.



Centering Work Accurately on a Three-Jaw Universal Chuck That Does Not Run True

TAKING STEREOSCOPIC PHOTOS WITH ANY CAMERA



Here Is a "Swing-Over" Base, Attachable to Any Tripod, Which Makes It Possible to Use an Ordinary Camera to Take Stereoscopic Views as Shown in the Upper Detail

"Three-dimensional" photos that give the impression of depth when viewed through a stereoscope, can readily be made with any camera by providing a special swing-over base on the tripod. Such a base consists of two pieces, the upper one holding the camera and the lower one attached to the tripod, four links being used to swing the upper piece either toward the left or right. All dimensions are given in the drawing, and those showing the distance the upper piece swings are of the greatest importance in order to obtain good results. The holes drilled in the lower piece accommodate the thumbscrew used to hold the camera. In use, the first photo is taken in one position, after which the camera is moved to the second position, the film turned, and another exposure made, being careful not to move either the object or the tripod. Two photos taken in this way are shown at the upper left-hand corner. Note that they are slightly different owing to the two positions of the camera. When both photos are mounted on a piece of cardboard that fits the holder of the stereoscope, and are viewed simultaneously, the three-dimensional effect is obtained.

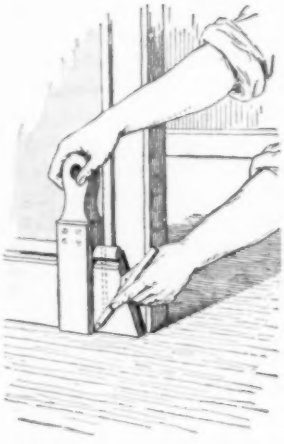
Killing Mites on Poultry Roosts

Before nailing down the roosts in your poultry house it will be found practical to lay 20-penny nails lengthwise on the framework at the point where the roosts are to be located, to serve as spacers. Staples are used to hold the nails in place. Space so provided between the roosts and the framework permits the lice-killing liquid, which is applied with a spray gun, to reach these points, which are otherwise inaccessible.—O. L. Brannaman, Sacramento, Calif.

Truck End Painted White for Safety

Drivers of large trucks traveling after dark can add to the safety of motorists by painting the endgates white. The light of rapidly moving cars approaching from the rear will then be reflected, giving the motorists sufficient warning.

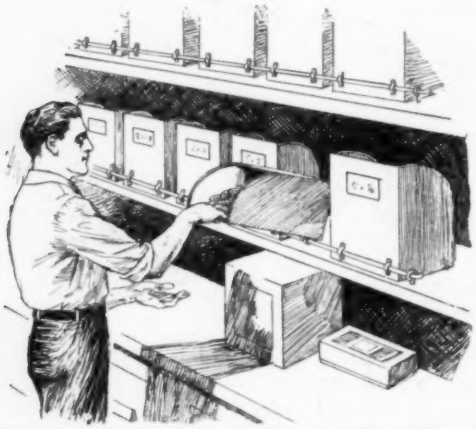
A Baseboard-Marking Gauge



For accurately marking baseboards so that they will fit snugly against door casings, a simple gauge, consisting of two pieces of ½-in. wood screwed at one end to a spacer of proper width, will be found useful. The gauge is slipped over the baseboard and against the door casing, after which the former can be marked. Of course, the edges on both sides of the gauge must be in perfect alinement.

Hinged Storage Cans for Small Parts

Containers for small parts can easily be made from square 1-gal. cans, by cutting off the top and part of the side as shown.



Containers for Small Parts, Hinged to Front Edge of Shelves, Are Easily Accessible

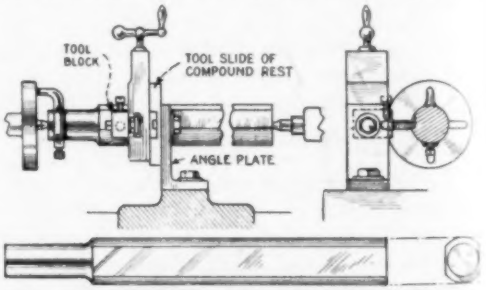
Fasten small metal straps to the front side near the bottom to receive a rod slipped through screweyes driven into the shelf. One end of the rod is bent over at right angles and the other drilled for a cotter pin to lock it.

How to Use Glue Properly

Gluing jobs often are unsuccessful because the worker does not follow certain simple, but necessary precautions. Assuming that the abutting surfaces are true, they must be free from grease or oil. After planing a true surface he often passes the hand over it, which is likely to leave a thin film of oil. The wet glue will adhere, but when it dries it will scale off under slight strain. Try-squares, plane irons and jointer tables should be kept absolutely free from oil for the same reason. A good gluepot should be used. In preparing the glue, one should also remember that it should be about the same consistency as light machine oil. A very small quantity should be put on the joint. If the glue is too thick or too much is used, that nearest the cold wood will set first. When this happens, the clamps will cause the boards to slide out of alinement. It is always desirable to have the wood warm when it is glued. This helps the glue penetrate the pores and prevents it from chilling quickly. Glue will not hold on wet or green lumber. Having applied the glue and set up the work, put on pressure promptly, before the glue begins to set. Chip glue should be covered with soft water and allowed to soak overnight, after which it should be heated in the gluepot but never over an open fire. Only enough glue should be prepared for a day's work, as successive heating and cooling weakens it considerably. To make a satisfactory waterproof glue for small patterns that give trouble in coming apart and also for veneering and other cases where great strength is not required, soak chip glue in water until it is soft and flabby. Drain and heat over water, adding enough boiled linseed oil, a little at a time, to brush out well when hot. A good "licking" glue is made by soaking two parts of chip glue in water until soft but still retaining its form. Pour off water, add one part sugar, and heat over water until dissolved. It may be brushed on articles to be gummed, such as labels and envelopes, or it may be cast into sticks and used by moistening the end and rubbing on the article to be glued. Wrap a band of paper around the stick so that it will not soil the hands when used.

Shaper Work Done on the Lathe

Where only a lathe is available, the illustrated attachment makes it possible to do shaper work. The top slide of the compound rest is removed, placed in a vertical position as indicated, and fastened by means of an angle plate bolted to the carriage. A tool holder or block is then bolted to the T-slot of the slide. In use, the lathe remains stationary, being held in position by throwing in the back gear.



Slide of Compound Rest Mounted on Angle Plate Is Used to Do Shaper Work on a Lathe

The tool is set against the work and the cutting done by moving the carriage along the ways with the handwheel. For each cut, of course, the tool is set down a trifle.—S. H. Johnson, New Haven, Conn.

Gasket Compound Has Many Uses

An effective gasket compound can be made of molasses and graphite. Stir enough graphite into the molasses to make a mixture as thick as can be stirred. This mixture expands under heat, and is, therefore, effective for sealing cylinder-head and exhaust-port gaskets. It is also useful on threaded joints of pipes carrying gasoline and oil, as it is not affected by these liquids. If applied to terminal connections on storage batteries, it will prevent corrosion.

A Ruled Disk for Measuring Irregular Surfaces

For measuring curved or uneven surfaces this ruled disk will be found convenient. Scribe and cut a circle 3 13/16 in. in diameter out of No. 22 gauge sheet iron or brass. Divide the outer edge into twelve 1-in. segments. Mark plainly with notches and number them from 1 to 12. Fractions of an inch can also be indicated if desired. Next make a handle by sawing a slot in the end of a length of ⅜ or ½-in. rod, to a depth of 2½ in. and wide enough to straddle the wheel. Drill a hole at the slotted end of the rod for a small bolt, which is also passed through the center of the wheel. In use, place the wheel with the No. 12 notch at the start of the surface to be measured and push it along, counting the revolutions.

A carbon scraper having a flexible point that will easily clean the irregular surfaces on an engine, can be made from an old table fork; bend the tines together at the end and file them to a sharp edge.

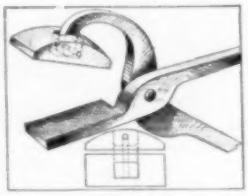
Coarse Mill or Bastard File Used as Improvised Knurling Tool on Lathe Work

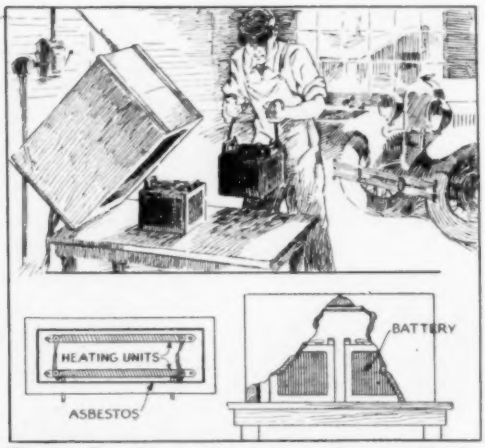
Knurling with a Coarse File

On small jobs where a knurling tool is not available, a good job can be done by using a coarse file in the following manner: Chuck the piece to be knurled in the lathe, or on an arbor if it happens to be a ring or sleeve. Remove the tool post and place a short piece of round stock, preferably hardened and about 1½ in. in diameter, in the T-slot of the compound rest, which is set parallel to the work. Now lay a coarse mill or bastard file over this improvised roller and under the work to be knurled as shown, with the compound rest adjusted so that the roller is located directly in front of, and almost under, the work. Then pull the belt by hand while guiding the file against the face of the work. With a mill file, it is possible to produce a good diamond effect if the file is reversed end for end.

This Tong Handles Tapered Work

A tong with a jaw that automatically adjusts itself to the surface of tapered work will often be found useful in a blacksmith shop. Take an ordinary tong and forge the top jaw to the shape shown, so that a pivoted member can be pinned on, a hole being drilled through this piece and filed square to accommodate the jaw, after which a hole is drilled for a pin.





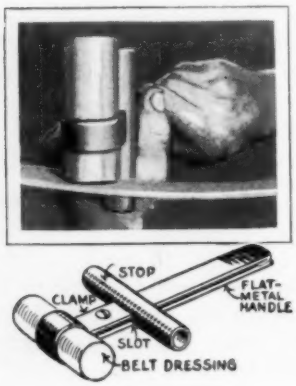
Wooden Box Lined with Asbestos Contains Heating Elements for Softening Storage-Battery Compound

Storage-Battery Compound Softened in Electrically Heated Box

When repairing storage batteries, the compound around the cells can be quickly softened with this electrically heated box, which should be large enough to cover two batteries. After lining it with sheet asbestos, fasten two 500-watt heater elements to the bottom. In use, the box is placed in an inverted position over the batteries and the current is turned on.

Holder for Belt Dressing

The danger of injury to a hand when applying belt dressing, is minimized by using this holder. A length of ⅛-in. flat iron is bent to form a clamp around the dressing, as shown in the detail, a small bolt being used to draw it tight. Cut a slot through the center of a piece of tubing, large enough to allow the handle to slide through freely. In use, the tubing forms a stop or guard against the edge of the belt, while the holder is slid back and forth so that the dressing will be applied to the entire surface.

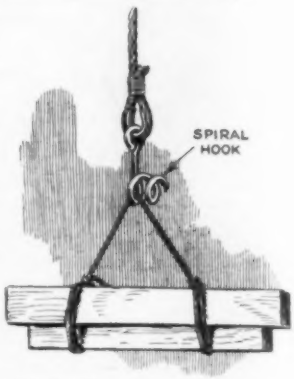


This Wall-Crack Filler Will Not Chip

A crack filler that will not chip, peel off or show through the finish on a wall can be made in the following way: Mix whiting with paint of the same shade as that to be used on the wall, adding enough paint until the mixture assumes a consistency slightly softer than freshly mixed putty. If the mixture is too thin, it will stick to your hands; it should be thick enough to be rolled between the palms without sticking. If the wall has not been sized, it is advisable to coat the cracks and edges of holes with paint, which is allowed to dry about four hours before applying the filler, using a putty knife to spread the latter evenly. In corners, take some filler on your middle finger and stroke it down into the crack, wiping off any surplus. Do not allow it to dry on your fingers as it sets quickly and is difficult to remove. Cracks or holes larger than 1 in. should be filled with patching plaster. This filler dries hard and smooth in 24 hours.

Spiral Hook Holds Hoisting Rope

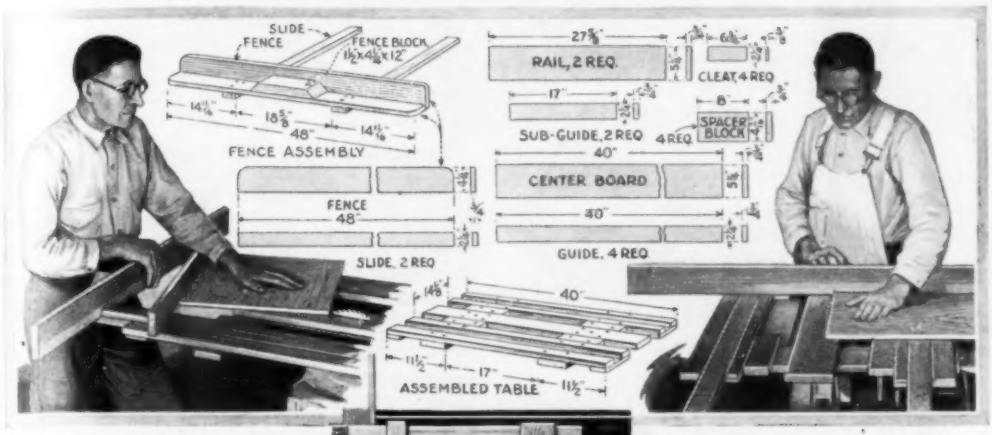
Use of a spiral hook when hoisting light material, will make the rope hold securely without slipping off. The hook is forged from wrought iron of size to suit the load.

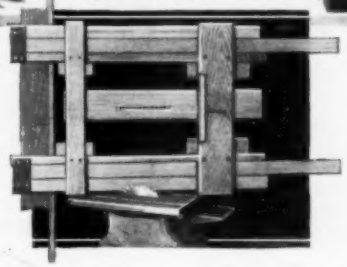


To Prevent Sticking Exhaust Valves

Some gasoline engines persist in giving trouble due to sticking exhaust valves. The heat of the engine causes the valve stem to expand and stick in the upper end of the valve guide. This condition can usually be overcome by cutting down the top of the guide a little by means of a spot-facing tool. It is not advisable to remove more than ⅛ in., which is generally sufficient to overcome even the worst cases of valve sticking.

THIS TABLE DOUBLES THE CAPACITY OF YOUR SAW





Small circular saws cannot be satisfactorily used with wide pieces of panel veneer or other stock, but it is an easy matter to build a wooden top to handle stock up to 30 in. in width. Straight-grained, seasoned maple or oak is preferable for the purpose. The dimensions given here are for a saw table 14⅛ by 17 in. in size, but can be varied to suit other tables, in which case only the rail lengths are changed, these equaling the width of the table plus 13½ in.

First make the guides from 1 by 3-in. stock. All pieces, especially the guides, must be brought to the same thickness, as accuracy is essential. When assembling the parts, start with the inner guides and center board. Mark the positions of the rails, clamp each joint, and drive a waxed nail through to hold it in place temporarily. When assembled, square the frame carefully, and put a clamp on each corner to hold the table rigid. This done, drill for screws. They should be as close to the edges as is reasonably possible, and staggered to avoid splitting. Take the pieces apart and ream the holes in the guides and center board with a drill just large enough to allow the screws to be pushed through. Countersink the heads 1/16 in. below the surface. Now assemble the frame temporarily with screws, after which it is tested for accuracy. Remove the screws, coat all joining surfaces with glue, and then replace them. Final tightening should be done with a clamp on the joint, to squeeze out excess glue, which should be wiped off immediately with a damp cloth. Then make the slides. To add the outer guides, lay the slides outside of the fixed guides, and put the other guides against them, shimming the edges with heavy paper for clearance. Hold together tightly with two bar clamps. Drill for screws as before, and glue and screw. Subguides, cut between the rails, are attached to bear against the sides of the iron table. For supporting the corners of the frame when it rests on the saw table, add spacer blocks to project equally on each side of the rails. They should fit tightly between the center board and the guides to obtain rigidity. Cleats, ⅜ in. thick, are glued and screwed under the ends of the guides, for additional support.

The fence is made by screwing two pieces at right angles as indicated. To the center of the base, on the upper side, glue and screw a block, mitered on the ends to make it more comfortable to the hand. Also round the corners of the fence and base. To attach the slides, clamp the fence to the table, square with the guides. Insert the slides between the guides, and drill for screws in the same way as was done for the guides. Put three screws through the base into each slide, and from underneath, one screw through each guide

Extra Saw Table Accommodates Stock of Large Size

into the lower edge of the fence. Do not glue the sides to the fence itself, for the latter may have to be replaced sooner than the base. Before putting on the wooden table, raise the machine table until the saw is covered. Be sure that it rests on the stop blocks. Put the fence in place, and try it for movement. If there is any binding, it is probably caused by expansion of the wood where the screws go through, and can be relieved by using sandpaper on a straight block. See that the fence is square with the miter-gauge grooves in the saw table. If this is not the case, wedge the wooden table over until it is removing such stock as is necessary. Then replace the wedge with enough metal shims to equal its thickness.

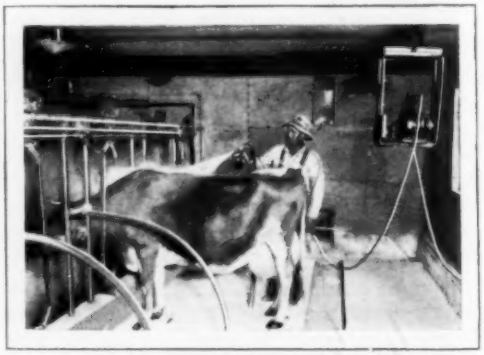
Now start the machine, lowering the table slowly until the saw has cut through the center board. A brace is needed to keep the far end of the frame from rising when the fence, carrying the stock to be cut, is well drawn out in front, and the method of doing this depends on the particular saw you have. Apply hot wax to all sliding surfaces in order to reduce friction, and rub the entire assembly with boiled linseed oil to protect the wood. In use, clamp a block on the fence to stop the end of the material. For angular cutting, use a board as an auxiliary fence, with one end against the stop and the other held with a stick tacked to the slide. Light miter cuts can be made by tilting the table in the usual way, but the saw must be lowered and allowed to cut a new slit after the angular setting. When not in use, set the table so that it will rest evenly on the ends of the guides in a flat position.

Smooth Finish on Concrete Walks

Flaking of rough concrete walks, which is caused by "puddling," owing to the liberation of air in the mixture after troweling, can be successfully overcome by troweling after the concrete has been allowed to stand for 8 or 10 minutes, or until bubbles appear at the surface. This indicates that the air in the concrete has been released, and the surplus water, which also rises to the surface, is then removed by troweling in the usual way. The result will be a smooth walk that will not scale. This advice was given by an old concrete engineer in the northwest who uses this method.

Fly Killer Sprayed on Cows with Paint Gun

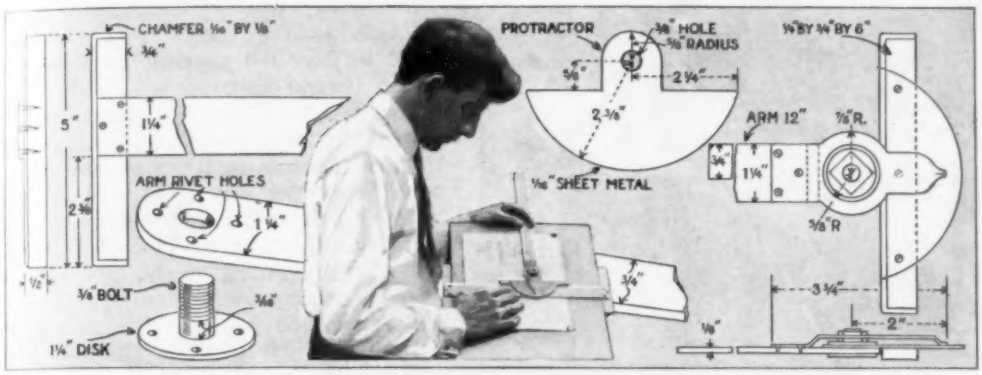
On farms provided with electric-lighting current, use can be made of an electrically operated paint spray gun for applying liquid fly killer to the cows. If mounted on a platform suspended from the litter-carrier track, the outfit can be moved about so that all the stalls can be reached readily.



Mounted on a Platform Suspended from the Litter-Carrier Track, This Spray Gun Reaches All Stalls

¶Cut flowers will remain fresh longer if placed in a wide-neck vase; a little borax, about the size of a pea, will usually help to revive wilted flowers.

LIGHT DRAFTING BOARD FOR OUTDOOR SKETCHING



This Light, Portable Drafting Board Has a Double-Headed T-Square and a Protractor That Serves the Purpose of Triangles, Enabling Accurate Work and Making It Ideal for Outdoor Sketching

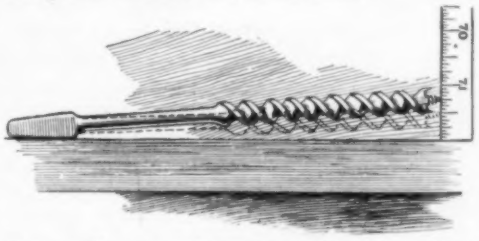
For a portable drawing board, fitted with a double-head T-square and protractor, this one will be found light to carry around and will enable the draftsman to make drawings with a reasonable degree of accuracy. The board is a piece of three-ply 3/8-in. pine veneer, well smoothed, with opposite edges perfectly parallel. The dimensions can be varied to suit the user. A nut on the back enables attachment to a camera tripod. For the T-square heads, use hardwood, 1/2 by 3/4 by 5 in. in size, and for the blade, 1/8 by 1/4-in. stock. Clamp the heads in position on the edges of the board with a strip of thin cardboard under them for clearance. Drill and countersink the ends of the blade for 3/8-in. flat-head screws, with which it is attached to the heads, putting a dab of glue under each end. Squareness is obtained by guiding the blade on a line previously squared across the board. The protractor arm, made of hardwood, serves the purpose of triangles. Saw a 9/16-in. piece from a 3/8-in. bolt, so that 3/16 in. will remain unthreaded. Solder the end to a brass or copper disk, 1 1/4 in. in diameter, as indicated. Drill both the wood and the disk with four holes, to admit five-penny nails for riveting to the arm. Saw the protractor according to the dimensions given, and drill the wide end to fit the pivot snugly. Also drill and countersink for three 1/4-in. flat-head screws, and attach to a wooden guide head, 1/4 by 3/4 by 6 in. in size. Assemble the head and arm, using a 3/8-in. square nut to clamp the latter in position. The pointer is shown at the right. It is screwed to the arm, spanning the nut and its washer, and bearing its point lightly on the protractor. To graduate the latter, make a deep scratch in the pointer, and set the arm to such angles as are frequently used, after which corresponding scratches are made on the protractor. Shellac the wood or merely rub it with boiled linseed oil.

Packing Sharp-Pointed Tools

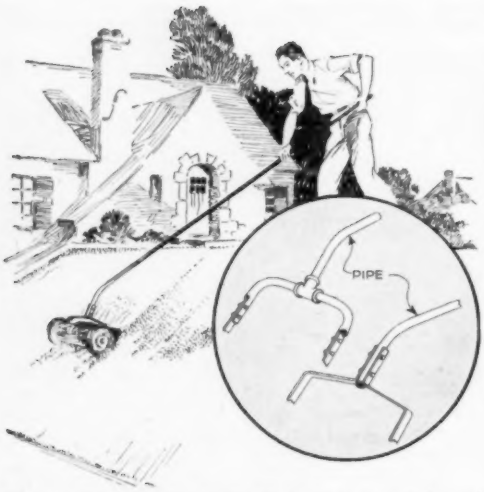
Sharp-pointed tools, such as files, punches and small screwdrivers, are rather difficult to pack so they will not punch holes in the wrapping material. Pushing a cork on the point ends the trouble.

Finding Wabble in Auger Bits

Small auger bits are often bent so they wabble when in use. To remedy this, lay the square shank on any smooth surface and hold a rule at right angles to this surface so that the point of the bit extends toward the scale graduations as indicated. The smooth side of a square can also be used for holding the shank of the bit with the point toward the other side.



How to Measure and Locate the Bend in a Wood Auger That Wabbles When Used



Cutting Grass on Banks Is Made Easier by Using an Extension Handle

Extension Handle on Lawnmower for Terraced Lawns

Mowing the grass on the bank of terraced lawns is rather difficult when using an ordinary lawnmower, but with an extension handle made of pipe and fittings, the task becomes comparatively easy as the worker can run the mower up and down the bank while standing at the top. A length of pipe is bent at an angle near one end, and the handle brace of the mower is bolted to it as shown in the insert. Another method of attachment is to screw the pipe into a tee, while short pieces of pipe, bent at right angles and flattened at one end, are also screwed into the tee. The flattened ends are drilled so that they can be bolted to the mower frame.—Warren F. Robinson, New Bedford, Mass.

Claw Hammer Tightens Wire Fence

By using an ordinary claw hammer, a wire fence that has become slack or stretched out of shape, can be tightened. Slip one claw over the wire and crimp until taut. This method can be used on either barbed or woven wire.

Safety First with a Scythe

The scythe, either of the grass or brush type, is a heavy unwieldy instrument and should be handled carefully if accidents from its long sharp blade are to be avoided. There is no better way of carrying a scythe than that employed before the advent of the mowing machine and binder, when the scythe was the universal tool for harvesting crops. The handles of a scythe, snath, which are grasped by the hands when cutting grass, are termed "nibs." To carry a scythe safely, the right arm is crooked around the second or lower nib, which rests in the crook of the elbow, the hand holding the snath several inches higher. The blade of the scythe is behind the man and to his right, with the sharp edge about parallel to the ground and facing to the front. Thus held, the likelihood of accident is reduced. Old-time farmers had one or two other scythe rules worth knowing. It was an unpardonable error to leave a scythe on the ground unless the blade was run under the grass and well covered. The proper thing to do, unless there was special reason for different practice, was to hang the scythe in the crotch of some tree where it could be seen.

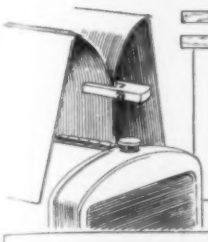
Rubber Band Protects Level Glass

To prevent level glasses from being broken when placed in kits with other tools, protect them as shown. Simply cut sections from an old inner tube and slip them over the glasses.

Foods Preserved in Running Water

Butter, eggs and other articles of food can be kept fresh and cool while camping, if they are placed in tightly covered containers and submerged, either partly or wholly, in a running stream. Even at home food can be cooled more quickly in ice water or running water from the faucet than in the still, cold air of the refrigerator.

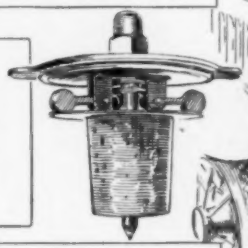
TEN WAYS OF SOLVING YOUR MOTORING PROBLEMS

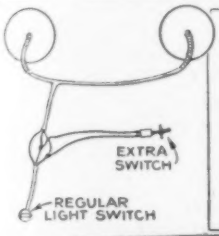


Both Sides of the Auto Hood Can Be Kept Open with a Huge Clothespin Having a ¾-In. Slot, and Reinforced with a Bolt to Prevent Splitting

Straightening Bent Axles and Similar Parts of the Car with the Aid of a Jack and Length of Heavy Chain

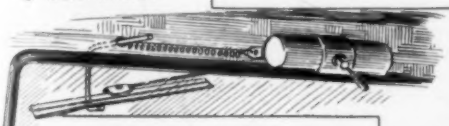
A Leaky Carburetor Float, Which Will Waste Your Gas Quickly, Can Be Replaced with a Large Cork and a Thin Disk Cut from a Tin Can, Which Is Placed over the Cork

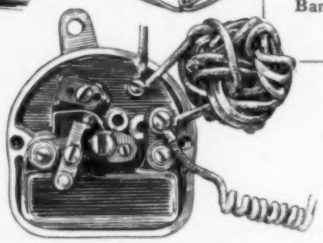




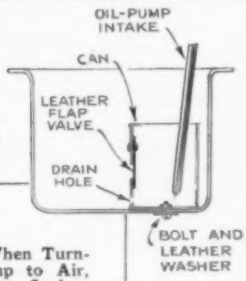
On Cars Having Lamps with Two Filaments, You Can Double the Amount of Light by Cutting an Extra Switch between One of the Bright Filaments and the Ground, as Shown in the Wiring Diagram at the Left

An Emergency Condenser Improvised from Two 40-In. Insulated Wires; after Taping One End of Each Wire, Wad Them Together to Form a Ball, and Connect the Two Bared Ends to the Breaker Terminals

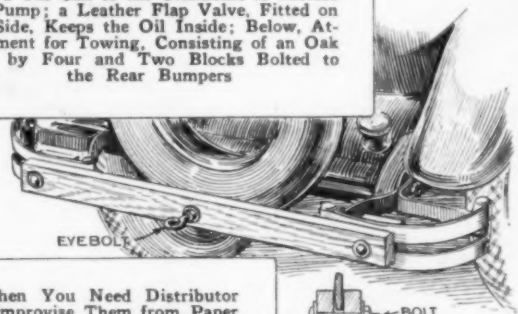


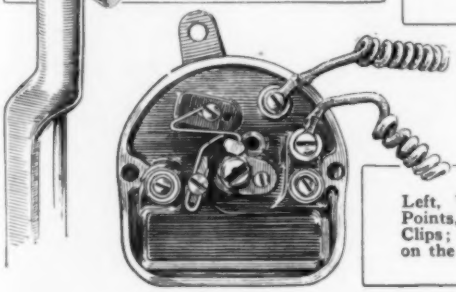


Above, a U-Shaped Hook, Made of Heavy Wire, Forms a Useful Holder to Prevent the Windshield Wiper from Obstructing Vision; Drill a Hole through the Windshield Frame to Accommodate the Hook and Provide a Coil Spring to Hold It in Place; in Order to Release the Wiper Merely Push the Hook Forward; Lower Left, Often Emergency Brake Levers on Cars Are of Such Construction That a Hole Can Readily Be Drilled through the Releasing Rod and the Handle to Receive a Small but Sturdy Padlock; If Your Brake Holds Tight This Method Will Foil Thieves

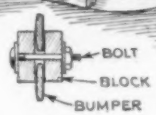


Right, to Avoid Interruption of Oil Flow Due to the Crankcase Oil Slushing toward One Side When Turning Corners, Exposing the Pump to Air, Bolt a Tin Can to the Crankcase to Inclose the Pump; a Leather Flap Valve, Fitted on the Side, Keeps the Oil Inside; Below, Attachment for Towing, Consisting of an Oak Two by Four and Two Blocks Bolted to the Rear Bumpers



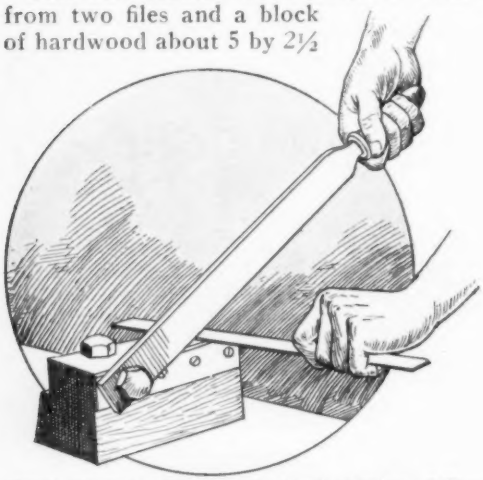


Left, When You Need Distributor Points, Improvise Them from Paper Clips; Bend and Fit a Piece of Wood on the End of One, to Ride the Cam



Bench Shears Made from Two Discarded Files

This serviceable bench shear is made from two files and a block of hardwood about 5 by 2½



Bench Shear for Light Sheet Metal Consists of Two Old Files and a Hardwood Block

in. in size. Drill and countersink three holes in a 3-in. piece of an old file for screws by which to fasten it to the block, which is recessed, so that this piece will come flush with the surface. For a cutter use a 12-in. file, drilled and pivoted to the block as indicated. The files should be annealed before drilling, then hardened and tempered again. The blades are, of course, ground to the proper cutting edge. A locknut prevents the pivot bolt from loosening or tightening while using the shears, and the block is securely bolted to the benchtop.

Using a Suction-Cup Valve Grinder

On valves that must be ground with the use of a suction-cup valve grinder, it is sometimes rather difficult to make the cup hold, due to the pitted surface of the valve. This trouble can be overcome by scraping the valve top and coating it with shellac, which fills the holes and provides a smooth surface for the suction cup.—J. H. Brundage, Katonah, N. Y.

Small Steam Leaks Stopped with Nitric Acid

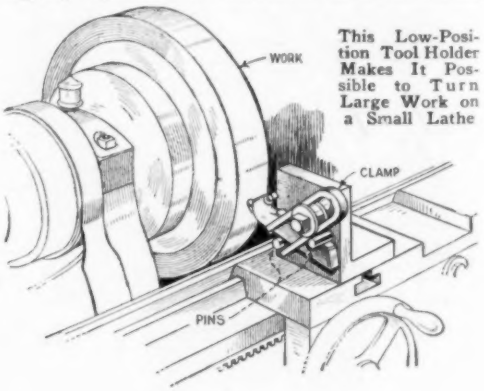
Small leaks around joints of steam pipes can be stopped by applying nitric acid. Disconnect the joint and apply a small quantity of the acid around the leak. Then replace the joint and allow it to stand for four or five hours before turning on the steam. The acid causes corrosion, which closes the leak. It is generally not advisable to use the acid on thin pipes as it may eat through them. When mending small cracks in this way, brush melted paraffin around the spot where the acid is to be applied. Besides iron and steel, the acid also affects brass and bronze.—F. E. Coombs, Randolph, Vt.

Compass Holes in Drawing Prevented with Celluloid Disk

Holes made in a drawing when using a compass or dividers can be prevented by using a small disk cut from a sheet of thick celluloid. Spread rubber cement over one side of the disk and allow it to dry. Place the disk on the paper directly under the pivot point of the compass or dividers, with the rubber-coated side down, to prevent it from slipping.

Turning Large Work on a Small Lathe

The drawing shows a tool holder used for turning large work on a small lathe not equipped with a compound rest. An angle plate of suitable size is bolted to the carriage and two pins are driven into holes drilled in the side of the angle plate. These pins, which should be tight-fitting, hold the tool rigid, so that it cannot be forced down by the work. A U-shaped clamp is then screwed tight against the tool, the screw being driven into a tapped hole in the angle plate and spaced with a washer as shown. In this way the tool is held rigidly against movement in all directions.



This Low-Position Tool Holder Makes It Possible to Turn Large Work on a Small Lathe

Tire Punctures Repaired without Cement

Punctures in inner tubes can be repaired without prepared patches or rubber cement. Cut a patch from an old inner tube and pour some gasoline over the puncture and on one side of the patch, after which the gas is ignited and allowed to burn until bubbles begin to form on the surface of the rubber. Then blow out the flame and immediately press the melted surfaces of the rubber firmly together, holding them in this position until cool. The same method applied to prepared patches will make them hold better, and as the cement used with these patches is usually inflammable, it is not necessary to employ gasoline.

Belt Dressing Consists of Tallow and "Neat's-Foot" Oil

Two pounds of tallow and 1 lb. of neat's-foot oil, melted together and applied hot, make an excellent dressing for leather belts. It should be put on with a brush, and a monthly application is usually sufficient.

File Handles from Wristpins

A wooden plug driven into a wristpin snugly forms a file handle that will not split. Drill a small hole in the plug and drive the file tang into it.

To Blue Gun Barrels

To blue gun barrels, take 4 oz. of sodium hyposulfite, 1 oz. of lead acetate, and dissolve separately in 1 pt. of water, then mix the solutions. Clean the gun barrel thoroughly with a solution of lye, heat the mixture and apply it hot to the barrel. After the blue color has been brought out, wipe the barrel dry and polish with oil.

¶If it is necessary to stop a machine when using tungsten-carbide tools, release the feed mechanism before starting, as the tools are easily broken when starting under a load.

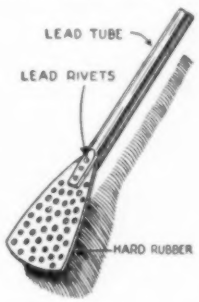
This Stand, Made of Angle Iron and Sheet Metal, Is Handy for Garages

Washing Stand for Small Parts

For washing small parts in a shop or garage, a specially made washing stand, equipped with drainboards, will be found useful. The frame members are of angle iron riveted together, two crosspieces being provided underneath to support a bucket for receiving waste. Two galvanized sheet-iron trays are fitted between the top members. A sliding cover for the trays, with a handle, may also be found convenient. The other end space of the top frame accommodates a sloping drainboard, also made of galvanized sheet iron and covered with a corrugated rubber mat.

A Paddle for Battery Acid

For use in storage-battery electrolyte, a paddle that will not deteriorate can be made from a piece of hard rubber, such as the side of an old battery jar, or phonograph record, and a piece of lead tubing, the latter being used as the handle. Saw out a piece to suitable size and perforate it with a drill, then rivet on the handle, which must be slotted to fit over the edge. The rivets, too, should be of lead.



Handling Long Work on a Small Saw Is Made Easier by Using This Adjustable Roller Support

Support for Sawing Long Planks

For supporting long planks while ripping them on a small circular saw, an adjustable roller will be of great help. It can be made from a length of ½-in. pipe screwed into a floor flange which is mounted on a wooden base. The top of the pipe is fitted with a reducing coupling which is drilled and tapped for a thumbscrew. A wooden roller, about 3 in. in diameter and 16 in. long, is pinned between the ends of a U-shaped bracket made of flat iron, to which a length of iron rod is attached as indicated. In use, the rod, which is slipped into the reducing coupling on the pipe, can be pulled out to the height of the saw table and held in this position by tightening the thumbscrew.

Washing the Car Differential

Before putting in heavy summer lubricant in your car, it is advisable to wash out the old grease thoroughly from the differential housing. This can be done by filling the housing up to the top drain hole with kerosene, after which the plug is replaced. Then jack up one wheel and run the motor in high gear for one or two minutes, which will have the desired effect. It not only removes the hardened grease, but also bits of metal, which are likely to cause excessive wear in the gears. It is, of course, absolutely necessary to drain every drop of the kerosene before refilling with new grease.

Solution for Removing Oil Stains from Machinery

Oil stains can be removed from machinery with the following solution: Dissolve finely shaved paraffin in benzol, equal parts of both being used, to make a fairly thick mixture. Apply this to the work with a brush, or if the work is small, immerse it in the solution. After allowing it to stand about an hour, wipe off the solution and finish with a cloth soaked in gasoline.

A Stropping Block for Tools

A strop, which will put a keen edge on tools, can be made by gluing an 8-in. length of 2-in. leather belting to a wooden block of the same size, after which the leather is thoroughly soaked with tallow. If a fast-cutting strop is desired, rub in powdered rottenstone with the tallow.

Roadside Stand Resembles Huge Frog

Roadside restaurants of unusual designs are becoming quite popular especially in some of the western states, and have been found highly effective in attracting customers. One of these, which arrests everyone's attention, is shown here. It resembles a mammoth frog, with its mouth, which holds the counter, wide open for business.—William Mallet, Santa Monica, Calif.

This Mammoth Frog, Forming the Front of a Highway Restaurant, Attracts Attention of Every Motorist

¶When cleaning a motor of carbon, a tire pump will be found convenient for blowing the particles out of cylinders, bolt holes, and the like.

UNUSUAL JOBS *in* WOODTURNING

NOW and then it is necessary or desirable to turn irregular shapes on the faceplate or to do work between centers that would be virtually impossible without the employment of some practical dodge, a number of which are given below.

Turning an oval is ordinarily impossible, but can be done by mounting the work off center. The work is first turned round as shown in the upper detail of Fig. 1, the diameter being left about ⅛ in. greater than the required long diameter of the oval. The lathe centers are then offset at two points as indicated, the distance from the true center determining the shape of the oval. Where the work is 2 in. or more in diameter and the centers are offset, the lathe spindle speed should never exceed 700 r.p.m. If the work is 3 in. or more, the speed should be reduced to 400 r.p.m., or less. An elaboration of oval turning is shown in the lower detail of Fig. 1. The product in this case is practically three-sided, and one application of such a turning is a full-length table leg, the top portion being left square. In this instance the centers are located on an equilateral triangle laid off on the end, and the vertices of the triangles must be in exactly the same position with relation to the work. The size of the triangles in the sketches is exaggerated for clarity. The work can be counterbalanced to a considerable extent by screwing a short piece of oak or maple to the square end opposite the heavy side of the piece. Make sure that all parts are clear before starting the lathe. Owing to the comparatively slow speed, the tools must be exceptionally keen-edged, and the work will be left somewhat rough, making it necessary to finish by sanding. Be careful to avoid injury by getting your finger between the work and the toolrest, a danger not present when work is turned between centers in the usual way. Do not sand the work while the lathe is running because of this danger and also because it takes off the edges.

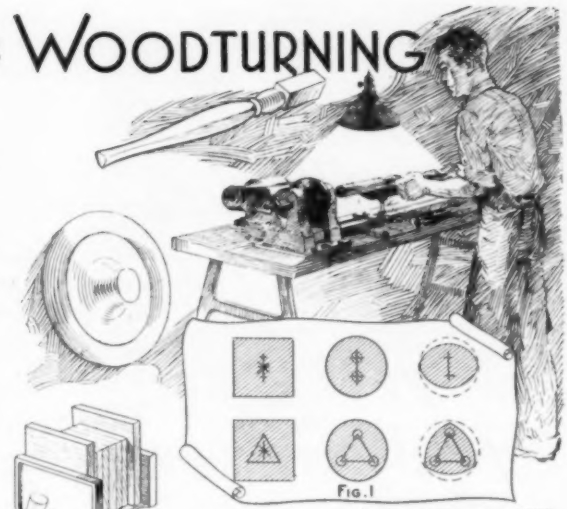


FIG. 1

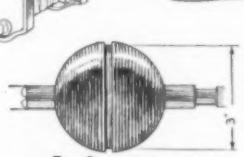


FIG. 2. ROUGHING THE BALL

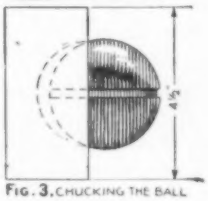
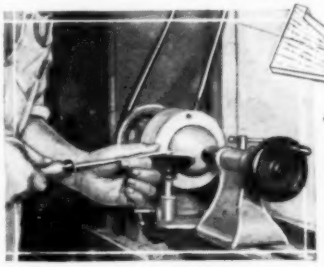


FIG. 3. CHUCKING THE BALL



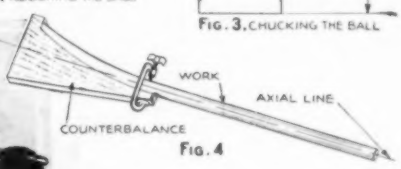
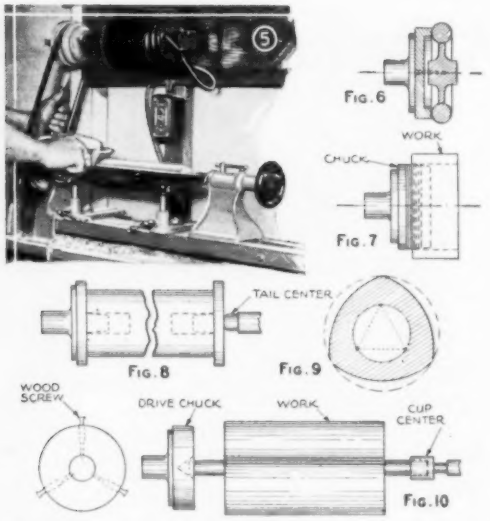


FIG. 4

The next job, shown in Figs. 2 and 3, is the turning of a sphere. Build up a block from square pieces of hardwood, gluing together and clamping overnight in a vise or cauls. Mount the block between centers and turn to the form shown in Fig. 2, leaving the diameter about ¼ in. greater than the required size of the ball. Then run a groove at the center, with a parting tool, to 1/16 in. of the finished diameter. Remove the work from the lathe, saw off the projections, and turn out a cupped chuck from soft wood, as shown in Fig. 3. The cupped portion should be deep enough to receive the ball, the widest part of the recess being about 5/16 in. less than the rough diameter of the sphere. Next, with the chuck on the lathe faceplate, push the ball into the recess with



Sharp Block Plane Turns Down Work of Small Diameter, Which Is Apt to "Whip"

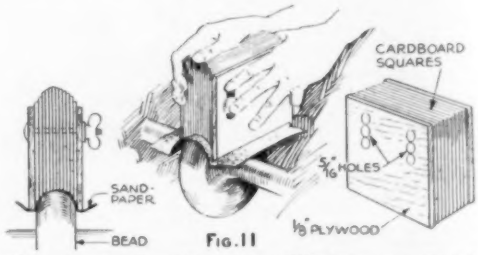
the groove exactly at right angles to the chuck face so that it can be used as a guide in turning. Bring up the tailstock and run up the cup center against the ball, to steady it. If care has been taken in truing the chuck, the lathe can be run at its highest speed to obtain a clean finish. After one half of the surface projecting beyond the chuck has been finished to the bottom of the groove, the ball is reversed in the chuck and the other half finished in the same way. Do not force the ball too tightly into the recess, as centrifugal force at high speed may split the chuck. A snug fit is sufficient to hold the ball.

Fig. 4 shows a practical method of turning bent work such as a chair leg. A support or counterbalance for the bent end of the leg is sawed from a piece of waste stock, the curved portion being made of the same contour as the bend in the leg. The support is clamped to the leg with a small C-Clamp and is mounted with the centers on the axial line.

An easy way of turning identical designs on both sides of faceplate work is shown in Fig. 6. The example is a wooden wheel with a raised hub and a round rim. Assuming that the wheel is to be 4 in. in diameter, true an improvised wooden chuck on the faceplate to about 3¾ in. in diameter, and sink a recess of such size and depth that the hub will clear it by about ⅛ in. Drive a small screw in at the exact center of the wood plate. Then mount the disk as indicated and turn it down, after which the work is reversed and the other side turned down. A similar way of chucking a ring that must be turned true on the outer and inner edges, is shown in Fig. 7. First turn a tapered chuck, the diameter at the face about ⅛ in. less than the inside diameter of the work. With a sharp scriber mark a series of guide lines, 1/16 in. apart, while the lathe is running. Then slip the work on the chuck, bringing the inner face even with one of the lines of the circumference. Do not force the work too tightly on the chuck; only a snug fit is necessary to hold it securely at high speed. True the inside of the work back to the chuck and true off the outer face. Then reverse the work and true the rest in the same way. Use the square-nosed tool for truing cuts.

Fig. 9 shows a design to accommodate a clock movement, the outside being turned to the triangular shape in the same way as shown in Fig. 1. A solid triangular piece makes a pleasing base for candlesticks as it is an unusual design.

A problem occasionally encountered is to get the circumference of a cylinder turned absolutely true with the holes drilled in the ends, which is almost impossible to do in a drill press after the work has been turned. One instance is shown in Fig. 8. The cylinder is first turned between centers, the diameter be-



Here Is a Sanding Block That Will Prove Its Usefulness for Curved Parts of Turnings

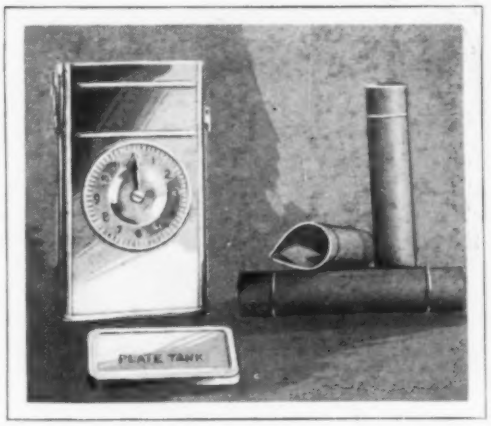
ing left slightly greater than the required finish dimension, care being taken to true the ends. The holes are then centered on the ends and bored to the required depth. Two disks larger than the work are sawed from 1¼-in. stock and mounted on the faceplate, and the face of each disk is sunk except at the center, where a tapered projection is left, about ¾ in. long, the

diameter at the shoulder being slightly greater than the hole in the end of the work. The second disk is left on the faceplate after turning, and the cylinder is mounted between these wooden centers as shown. In Fig. 10 is shown a cylinder driven on a steel shaft and keyed with a pin, to be turned true with the shaft. To do this between centers requires the use of a driving chuck and a cup center, both made of maple. A V-shaped hole, which takes the end of the steel shaft, is turned in the center of the chuck. The diameter of this hole must be greater than the shaft, which is held in place and prevented from turning by means of three wood screws equally spaced about the circumference of the chuck, the heads driven below the surface, as exposed screw heads are dangerous. The cup center is bored to a snug fit on the opposite end of the shaft. The driving dog or chuck is left on the faceplate.

For sanding irregular turnings, use can be made of the holder shown in Fig. 11. Cut about 50 pieces of stiff cardboard, each 4 by 4 in., and clamp these between two pieces of ⅛-in. plywood. Make two slots by drilling holes for bolts to hold the assembly together, the bolts being provided with wingnuts to facilitate adjustment. In use, the bolts are loosened and the cardboard center section pressed on the curved surface to be sanded, and the bolts then tightened to hold the assembly in this position, after which a piece of sandpaper is placed between the holder and the work, as shown in the center detail. A concave depression can be sanded out in the same way. The bolts must be left loose so that the paper squares can adjust themselves to the contour of the work.

When turning work of small diameter, as ¾-in. dowel stock or the like, in lengths greater than 6 or 8 in., it is likely to whip, making accurate turning almost impossible. This tendency can be effectively overcome by using a sharp block plane, as shown in Fig. 5. Be sure that the plane is razor-sharp, set it to take a light cut and hold it at a slight angle to the work with the heel against the toolrest.

¶An abrasive wheel will glaze over, if it is too hard or run at a high speed.



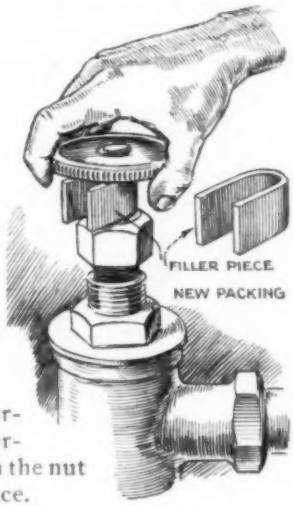
Cut Films Rolled in Black Paper Can Be Developed in Film-Pack or Plate Tanks

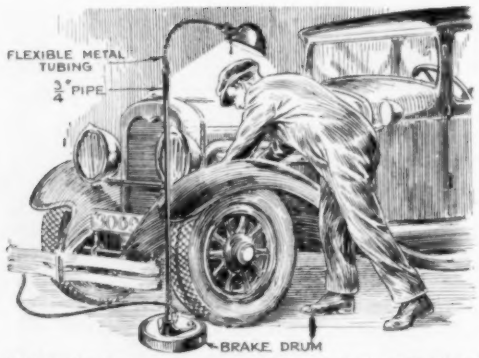
Developing Cut Films in Plate and Film-Pack Tanks

Cut films can be developed in either a plate or film-pack tank. Wrap the black paper that comes between the films, around them on the side not coated with emulsion, slip a rubber band around them, as shown in the left-hand detail, and place them in the tank. A 4 by 5-in. tank, with the cage removed, will hold three 5 by 7-in. films using this method. Fill the tank to the upper ring with any good tank developer and insert the films.—P. B. Bacheller, Mt. Vernon, Me.

Renewing Valve Packing

For repacking a large number of steam valves in an apartment building, a mechanic used a U-shaped piece of sheet metal under the stem to force the nut over the packing by turning the handwheel. Before using this device, it was often necessary to remove the handwheel in order to apply vertical pressure on the nut to force it in place.





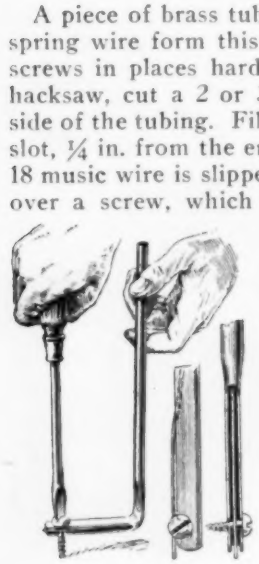
Old Brake Drum, a Length of Pipe and Flexible Metal Tubing, Make a Good Garage Lamp

A Floor Lamp for the Garage

When working on your car in the garage, the difficult task of holding the light at the proper angle can be simplified by using a floor lamp as shown. It is made from an old brake drum, a 4-ft. section of ¾-in. iron pipe and an 18-in. length of flexible metal tubing. Solder one end of the tubing into a coupling screwed to the end of the pipe, and attach a light socket to the other end. Run the cord through the tubing and pipe, and out of a small hole drilled in the side of the drum. The pipe may be welded to the drum or attached in any other suitable way.

Holding Screws in Places That Are Hard to Reach

A piece of brass tubing and a length of spring wire form this holder for starting screws in places hard to reach. With a hacksaw, cut a 2 or 3-in. slot down one side of the tubing. File a notch across the slot, ¼ in. from the end. A length of No. 18 music wire is slipped into the tube and over a screw, which is laid in the slot.



The wire can be permanently fastened by squeezing the uncut section of tubing flat in a vise. The wire should project a short distance from the slotted end so that it can be pulled up when inserting a screw. In many cases it will be found convenient to have the flattened portion bent over at right angles near the slotted end, as shown in the left-hand detail.

Drilling Glass with a Slotted Rod Prevents It from Breaking

Glass is often broken when drilling it with a brass or copper rod and fine grit, because the alternate raising and lowering of the rod allows the grit to flow between it and the glass. This trouble can be eliminated by sawing a slot lengthwise in the end of the rod. Grit caught in the slot slowly seeps out as the rod rotates. When the hole is drilled about halfway through, reverse the glass and start from the other side.

Inverted Pocket on Overalls Keeps Rule from Being Lost

Often a rule, pair of pliers or other tool slips out of the side pocket of overalls and is lost. This trouble can be prevented by sewing an inverted pocket just above the regular pocket, as shown in the drawing. Enough space is left between the two, as shown, to enable the tool to be easily inserted or withdrawn from the pocket.—Ross Rocklin, Cincinnati, Ohio.

Lining Up Conveyor-Leg Brackets

When installing a long conveyor, it is usually rather difficult to line it up properly, especially if the floor is not level. Angle brackets bolted to the legs will give the legs that do not touch the floor a sturdy support. First drill the angle brackets and bolt them to the floor. Drill holes through the sides of the brackets and in the conveyor legs, and then fill up the space between the brackets and legs

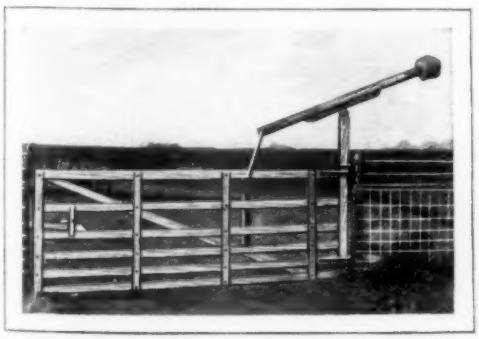
with lead, babbitt or concrete, using a mold around the leg to hold the filling in place. A form can then be made to cover the angle bracket, leg and filling. Pour concrete in this form to give the end of the leg a finished effect. This will increase the strength of the base and make a good-looking job. If enough screw jacks are available, each leg can be raised to the proper level and held in place with shims or blocks until the angle brackets and legs are drilled and bolted in place.

Finishing Brass Turnings

Brass or bronze turnings can be given a beautiful line finish in the following manner: Place strips of leather between the lathe-chuck jaws and the work to prevent marring, and run the lathe at its highest speed. Spread oil over the surface of No. 2 emery cloth, and hold it against the work, starting at the center, and moving toward the ends. Repeat this operation until a rough finish appears, after which go over the work with No. 00 emery cloth. While running, wipe the work with a soft cloth. Then spread oil over the surface and finish the lining with fine French emery paper, using a soft cloth to remove dirt and add luster.

Farm Gate with Counterweight Relieves Strain on Post

By providing a higher post than is customarily used to hold the hinged end of a gate, and pivoting a crosspiece with a counterweight to the post, the free end of the crosspiece being linked to the gate as shown, the strain on the post is relieved and opening of the gate is easier.



Lifting Heavy Gates Made Easy and Strain on Posts Relieved by Using a Counterweight

Table with Cutting Strips and Stop Facilitates Quick Cutting of Drafting Paper to Any Size

Cutting Drafting Paper Quickly on a Slotted Table

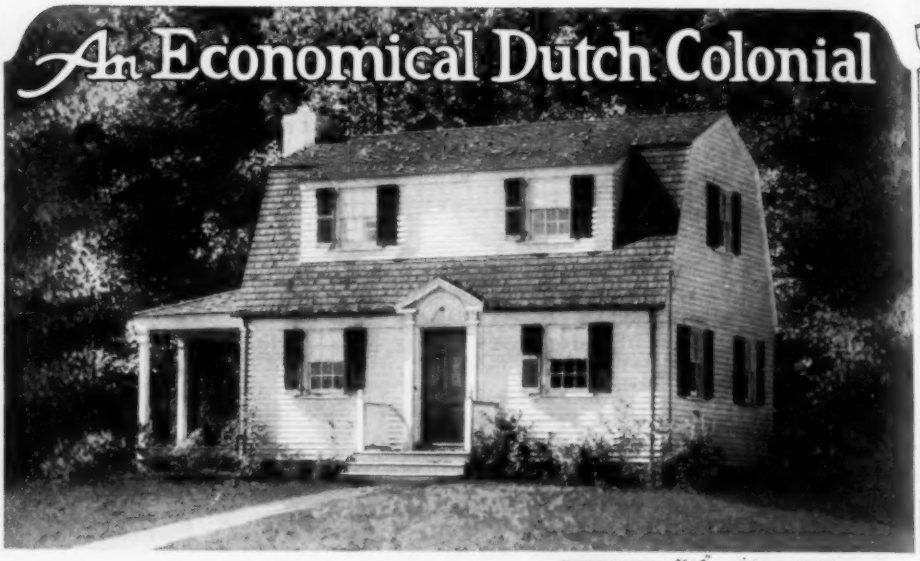
Drafting paper can be cut off squarely by providing two strips of flat metal on the table top so that a knife edge can be run between them as shown. This will be found a timesaving method in schools and commercial drafting studios. A groove of sufficient width and depth is cut to receive the strips so that they will be flush with the surface of the bench top. Countersunk holes are drilled through the strips and flat-head wood screws used to hold them in place. In order to measure off required widths of paper quickly, use is made of a flat-metal stop, bent over at right angles at both ends to fit the bench, and provided with a thumbscrew so that it can be fastened at any point along the edge of the table, which is graduated to form a measuring rule.—E. G. Asker, Sarnia, Can.

Auto Starter Used for Buffer

As a substitute for a motor, a western automobile shop uses an auto-starting motor to operate a buffer for tire repairs. Battery and switch are under the workbench, and the self-starter is fitted with a rotary buffing wheel. The buffer is started by pressing a foot switch, saving the trouble of going to a wall switch.

¶About 150 lb. nitrate of soda to the acre will kill moss on meadow land.

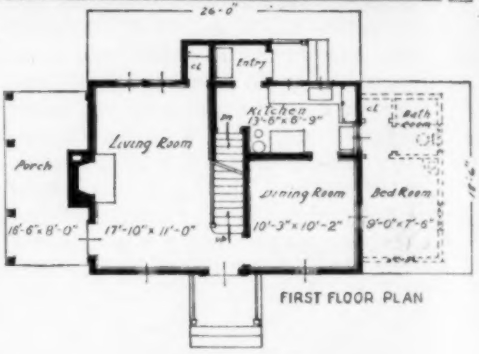
An Economical Dutch Colonial



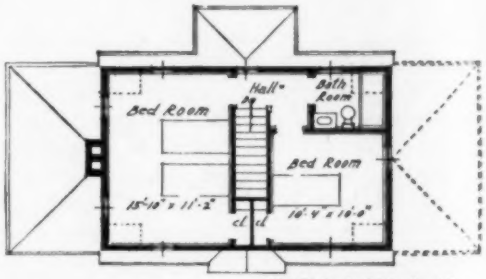
© The Architects' Small House Service Bureau **Plan 5-F-14**

HERE is a straightforward house without pretense or elaboration; yet so finely balanced are all the larger things, and so well proportioned the smaller details, that real charm has been achieved. Its fine character is the result of well-studied proportions and harmony of details. The cost of these things is small in comparison with the higher resale value they bring to the property, and the increased satisfaction they afford the owner.

For its dimensions, the house is really commodious, for it has been planned to eliminate waste space. Comfort and convenience have been the aim. In the living room, space has been saved by turning the stairway directly into the room. With the fireplace at one side and the stairway at the other, the room becomes an unusually interesting one. A French door at one side leads to the open porch.



FIRST FLOOR PLAN



SECOND FLOOR PLAN

In the plan a prospective wing is shown at the right of the main mass of the house, indicating how the house may be extended to include a downstairs bedroom and bath, or perhaps a sun porch. In the second story there are two substantial bedrooms, each with an excellent closet. The corners of the bedrooms are encroached upon by the roof only to a slight extent.

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